

**Karolina Oracz**

**MAJOR RESEARCH PROJECT**

# THE RELATIONSHIP BETWEEN ADULT ATTACHMENT STYLE AND FIBROMYALGIA AS MEDIATED BY SOCIAL COGNITION

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## Summary

### Section A

This section provides a review of research literature investigating the relationship between fibromyalgia syndrome and social cognition, as well as fibromyalgia and attachment. An overview of the theoretical background is given, and the empirical literature is summarised and critiqued. A need for further exploration of these relationships is identified.

### Section B

A quantitative, cross-sectional design was employed to compare experiences of 105 individuals with fibromyalgia and 172 healthy controls (HC). A correlation and a mediation analyses were used to explore relationships between insecure attachment, social cognition, and fibromyalgia symptoms.

Results revealed that psychological distress is strongly related to fibromyalgia and significantly influences the way fibromyalgia is related with insecure attachment and poor social cognition. The mediation effect of social cognition on the relationship between fibromyalgia and insecure attachment was not confirmed. Implications for clinical practice and future research are discussed.

### Section C

This section comprises of a critical appraisal of the research process in answer to four questions. These explore reflections on what has been learned, what might have been done differently, and the clinical and research implications

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**Karolina Oracz**

**MAJOR RESEARCH PROJECT**

**SECTION A**

**LITERATURE REVIEW**

# The relationship between fibromyalgia, social cognition, and attachment

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**Abstract**

Research exploring relationships between chronic fatigue and pain conditions with attachment or social cognition continues to grow. This paper looked to explore these relationships in a specific syndrome called fibromyalgia, which combines both chronic pain and fatigue. For this purpose a systematic literature search was carried out through on-line databases including ASSIA, Cochrane, CINAHL, PsycINFO, and Web of Science, using a combination of terms.

The search yielded 12 papers focusing on the relationship between fibromyalgia syndrome (FMS) and social cognition, and six papers exploring the relationship between FMS and attachment. Some papers crossed over between the two areas (Griffies, 2010; Pedrosa Gil et al., 2008).

The majority of findings suggest a strong relationship between poor social cognition and FMS. However, not all studies attest to this. The prevalence of poor social cognition in FMS, noted between 15% and 47%, is repeatedly higher than in the general population or other pain conditions. Nevertheless, studies differ in reporting whether this relationship is direct, or whether it is mediated by psychological distress.

Literature also affirms the relationship between FMS and insecure attachment. It is suggested that around 41% of the population with FMS has an insecure attachment style. Studies show that especially avoidant attachment style is higher in FMS than in the general population.

Further findings across both relationships are discussed. Implications for clinical practice as well as future research are identified.

Key terms: fibromyalgia syndrome, social cognition, alexithymia, mentalization, theory of mind, attachment.

## Introduction

The research exploring fibromyalgia continues to develop, but its aetiology remains unclear. This paper looks to systematically review literature linking fibromyalgia syndrome with social cognition and attachment.

### Fibromyalgia

The term Fibromyalgia comes from a Latin word "fibro" meaning fibrous tissues, and Greek words "myo"- muscle, and "algos" meaning pain. It directly translates "muscle and connective tissue pain". Fibromyalgia syndrome (FMS) is characterised by widespread chronic pain (lasting over three months) and tenderness in at least 11 out of 18 designated tender points distributed across upper and lower body (Wolfe et al., 1990). Other typical symptoms are heightened sensitivity to pressure, disrupted and unrefreshed sleep, extreme fatigue, stiffness of muscles, ligaments and tendons, difficulty swallowing, problems with bladder and bowels, numbness, tingling, as well as cognitive problems such as difficulty with memory and cognition (Glass, 2006; López-Pousa et al., 2013). Although similar to arthritic pain of the joints, FMS does not cause inflammation or damage to the joints, muscles, or other tissues (Wright, 2011). It belongs to group of disorders sometimes called functional somatic disorder (FSD). Often people with FSDs suffer from anxiety and/or depression, and functional impairment of activities of daily living (ADLs).

FMS is a diagnosis of exclusion, which means that a thorough history taking, physical examination, and laboratory evaluation need to take place to eliminate a possibility of presence of any other medical disorder which could be causing similar symptoms. There is a growing body of evidence that both biological and psychological factors exacerbate its development and course (Clauw, 1995; Van Houdenhove & Luyten, 2007). Researchers suggest that following an intensive physical or psychological distress, the hypothalamic-pituitary-adrenal axis (HPA) - an essential neuroendocrine feature of FMS, switches from the

state of "under-drive" into "overdrive". HPA axis is a complex set of direct interactions among three endocrine glands: the hypothalamus, the pituitary gland, and the adrenal glands. It is a major part of the neuroendocrine system that controls and regulates stress body processes (Selye, 1974). As a result of the switch to "overdrive" mode, the inflammatory activity is exacerbated and the brain perceives pain where before it would only interpret such signals as uncomfortable or stiff (Clauw, 1995; Van Houdenhove & Luyten, 2007).

FMS affects two to four percent of the worldwide population, is nine times more likely to affect women (especially white women) than men (Wolfe et al., 1995), and is most common in the 20-50 age group; however, children and older people can also receive the diagnosis (Chakrabarty & Zoorob, 2007). Unfortunately, to date, there is no cure for FMS. A holistic approach combining education, lifestyle changes, exercise, good pain management, psychotherapy, as well as appropriate medication, is currently used to help people decrease the symptoms and regain control over their lives.

**Attachment**

There is a wide interest in the way trauma in early life and attachment style influence onset, utilization of health care, and prediction of recovery from FSDs such as FMS (Hammill, 2010; Lumley, 2011; Luyten & Van Houdenhove, 2012; Mayer, 2000;). Bowlby's theory of attachment (1969/1979) proposed that the relationship between a cognitively developing child and their primary caregiver, through the caregiver's responses to the child's needs, shapes future responses of the growing person to significant others. The attachment theory has been further developed for other stages of human development including adulthood (Ainsworth, 1989; Bartholomew & Horowitz, 1991; Hazan & Shaver, 1987; Main, Kaplan, & Cassidy, 1985). Studies attest to the relationship between chronic pain in general and insecure attachment (Davies, Macfarlane, McBeth, Morriss, & Dickens, 2009; Meredith, Ownsworth, & Strong, 2008; Mikail, 2003; Oliveira & Costa, 2009), but the literature

exploring connections between FMS and attachment is scarce. Insecure attachment can be described using a two dimensional model: anxiety and avoidance, as proposed by Hazan and Shaver (1987). They suggested that if an infant endures inconsistent and intrusive care from their primary care giver, as an adult s/he is likely to develop anxious style of relating to their significant other. They might excessively seek reassurances from their partner due to fear of abandonment. If however one meets with "cold", rejecting, or neglectful care, as an adult they might be prone to developing avoidant attachment style in their significant relationships. This could manifest in mistrusting others and feeling excessively uncomfortable with intimacy and dependence on others. Gregory and Berry (1999) suggest an approach-avoidance or counter-dependency dimension, where people engage in conflictual relationships marked either by a striving to be completely self-reliant or else become very dependent on others.

**Fibromyalgia and attachment**

A significant percentage of the population with FMS report higher than average rates of childhood abuse and victimisation, experiences which often accompany insecure attachment status (Häuser, Kosseva, Uceyler, Klose & Sommer, 2011). Furthermore, psychoneuroimmunology studies (Kendall-Tackett, 2009) affirm long lasting effects of sustained stress on the body's immune and stress systems. It could be expected that patients with disturbed attachment patterns would be predisposed to develop chronic pain conditions. Meta-analysis by Davis, Luecken & Zautra (2005) showed a modest but significant relationship between chronic pain and abuse. However, the effect sizes attesting to this relationship varied widely and some studies (Alexander et al., 1998; Raphael, Widom & Lange 2001) show that the link is not always clear. Not all people, who were abused as children, do go on to develop insecure attachments (Fonagy, Steele, Steele, Moran & Higgitt, 1991) and/or chronic pain (Van Houdenhove, Luyten & Van Den Eede, 2008). It is possible

therefore, that another factor is indirectly determining whether these negative life experiences are perceived as so stressful that the body's immune system is overloaded.

**Social cognition**

Researchers are increasingly interested in the connections between FMS and the ability to recognise ones' own and others' feelings and/or mind. Fonagy et al. (1996) suggested that social cognitive abilities, such as theory of mind, mentalization, or alexithymia, act as mediators of early attachment experiences in the development of later psychological difficulties. Luyten and Van Houdenhove (2012) have extended mentalization theory from psychopathologies to physical health problems such as functional somatic disorders.

Theory of mind is the ability to attribute mental states, beliefs, needs, intents, and desires to oneself and others. Furthermore, it requires the understanding that others have beliefs, desires and intentions different to one's own (Baron-Cohen, 1989; Premack & Woodruff, 1978). In other words, the theory of mind is that part of social cognition that helps us to predict or explain other people's actions, and to posit their intentions.

Bateman and Fonagy (2004) named the mental process of interpreting one's own and others' mental states as mentalization. Mentalization offers a broader, more developmentally based theory of social cognition than theory of mind, and furthermore encompasses affect, consciousness, and regulation. In addition, theory of mind tends to focus mainly on mental states in others, whereas mentalization theory addresses social cognition of "self" as well as "others".

Alexithymia is a difficulty identifying and describing feelings, and is associated with deficits in cognitive processing and affect regulation (Kooiman, Bolk, Rooijmans & Trijsburg, 2004). Sifoneos in 1972 was the first one to use this term meaning "no words for mood". People with alexithymia often present with somatic symptoms (Lesser, 1985).

Because of the theoretical similarities between theory of mind, mentalization, and alexithymia, and until recently a lack of a validated mentalization measure, much of the published research focuses on assessing social cognition using the Toronto Alexithymia Scale (TAS; Taylor et al. 1988), or the Reading the Mind in the Eyes Test (RMET; Baron-Cohen et al, 2001).

**Fibromyalgia, social cognition, and attachment**

Mentalization theory predicts that social cognitive impairments arise in the context of insecure childhood attachments. Poor early attachment relationships, where one has never been properly taught by his/her primary care giver through sensitive modelling to understand internal mental states, to think and be aware of his/her own emotions and feelings, nor those of others, lead to poor social cognition or poor mentalization (Bateman & Fonagy, 2004). This means that one might concretise his/her experience more and understand them more in terms of the body (somatic complaints) rather than thoughts and feelings. Also, the poor ability to make sense of and regulate mental states in themselves and in others might lead to more stress on the HPA axis, which in turn physiologically increases chances of developing FMS. This finds confirmation in research showing that patients with FSDs tend to misinterpret their own emotional signals as bodily sensations (Subic-Wrana, Bruder, Thomas, Lane, Köhle, 2005) and have a deficit in general theory of mind (Subic-Wrana, Buetel, Knebel & Lane, 2010).

It is arguable that mentalization ability can help to overcome the effects of early life stresses and help the individual become more resilient (Fonagy & Target, 1997). Individuals who can identify and talk about their own and others' inner states may be able to better process and therefore neutralise these noxious experiences. In other words, those who have well developed social cognition mechanisms are more likely to develop emotional resilience and ability to cope with stressful life events. It has been suggested that attachment status

alone does not predict illness severity (Van Houdenhove, Luyten, Van den Eegle, 2008), nor does poor mentalization independently cause FMS, as not everyone with poor social cognition develops this disorder. Understanding the link between FMS, social cognition, and attachment could improve the understanding of the underlying mechanisms of FMS, and inform treatment options. Therefore, this paper aimed to review the research literature addressing the relationship between FMS and social cognition, and between FMS and attachment.

## Methodology

A systematic literature search was carried out on several on-line databases including ASSIA, Cochrane database of systematic reviews, CINAHL, PsycINFO, and Web of Science. The search was limited to peer-reviewed articles published in English language journals (for details of the search methodology see Appendix 1). Subsequently 12 papers were selected for the review of the relationship between FMS and social cognition, and six for the relationship between FMS and attachment connections (see Appendix 2 and 3 for the overview of selected studies). Some of the FMS literature on attachment and social cognition in the population with FMS crosses over, e.g. Griffies (2010) or Pedrosa Gil et al. (2008), which will be explored in more detail later.

## The relationship between FMS and Social Cognition

As in the majority of the research exploring social cognition, the Toronto Alexithymia Scale (TAS; Taylor et al. 1988) was used as the main social cognition measure in all the studies selected for this review. All but two (Bartley, Rhudy, & Williams, 2009; Malt, Olafsson, Lund, & Ursin, 2002) of the reviewed studies confirmed a relationship between poor social cognition (alexithymia) and FMS. The prevalence of alexithymia in the population with FMS varied between 15% (Pedrosa Gil et al, 2008; Sayar, Gulec, & Topbas, 2004) and 44% (Steinweg, Dallas, & Rea, 2011) or even 47% if the subclinical levels of

alexithymia were to be included in the count (Castelli et al., 2012). Those studies confirming the relationship between FMS and alexithymia which used control groups (Peñacoba Puente, Velasco Furlong, Gallardo, & Cigarán Méndez, 2013; Sayar et al., 2004; Steinweg et al., 2011; Tuzer et al., 2011; Van Middendorp et al., 2008; Weiβ, Winkelmann, & Duschek, 2013) observed that alexithymia was significantly higher in the population with FMS than in the healthy control (HC), or the populations with rheumatoid arthritis (RA) or chronic low back pain (CLBP). Also, those studies which did not use control groups, but compared their data to those of general population statistics (Castelli et al, 2012; Pedrosa Gil et al., 2008) noted a higher prevalence of alexithymia in the population with FMS. Peñacoba Puente et al. (2013) additionally noted this higher prevalence in FMS to be present across the age groups. They reported that the strength of alexithymia continues to increase with age in FMS, and so do depression and anxiety. Sayar et al. (2004), Van Middendorp et al. (2008), Huber, Suman, Biasi, and Carli (2009), and Castelli et al. (2012) reported that the main alexithymic difficulty present in the population with FMS was the "difficulty identifying feelings" rather than the other aspects of alexithymia ("difficulty describing feelings" or "externally oriented thinking").

Two out of 12 studies (Bartely et al., 2009; Malt et al., 2002) suggested that there is no significant relationship between FMS and social cognition. Malt et al. (2002) reported no difference in alexithymia between FMS and HC. However, they suggested that social cognition may be related to psychological distress. They reported a significant positive correlation between levels of alexithymia, and levels of anxiety, depression and neuroticism. On the other hand Bartley et al. (2009), found no significant differences between HC and FMS in either depression or alexithymia. It is important to note however, that both of these studies reported small sample sizes, which may have led to type two errors. Also Malt et al. (2002) excluded participants with very commonly occurring comorbid conditions

(e.g. irritable bowel syndrome, or migraine). These stringent inclusion/exclusion criteria might have excluded those participants with greater severity of symptoms, therefore further reducing the generalisability of these findings.

**Alexithymia and psychological distress**

The majority of the reviewed studies showed that psychological distress was positively correlated with alexithymia. Castelli et al. (2012), reported that 60% of the population with FMS suffers from depressive and 52% from anxiety symptoms. In their study, the perceived pain intensity correlated with depression but not alexithymia, thus suggesting that psychological distress might be influencing the relationship between FMS and social cognition. Similarly Huber et al. (2009), Pedrosa Gil et al. (2008), Steinweg et al. (2011), and Tuzer et al. (2011) reported that anxiety, depression, and psychological distress influence/mediate the relationship between social cognition and FMS. They observed that when psychological distress was controlled for, the correlation between alexithymia and FMS became insignificant.

By contrast, Sayar et al. (2004) and Greenen et al. (2012) found that the relationship between alexithymia and FMS remained significant even after controlling for psychological distress. Furthermore, Greenen et al. (2012) demonstrated that alexithymia, anxiety, depression, and the tendency to suppress anger, were higher in FMS than in the RA or HC groups even after controlling for pain severity. Similarly, Weiβ et al. (2013) showed that in FMS difficulty recognising others' facially expressed emotions was independent from psychological distress (anxiety and/or depression). These findings lend strong support for a relationship between social cognition and FMS. However, the research is contradictory whether this relationship is independent of psychological distress or not.

Huber et al. (2009), using different mechanical and thermal stimuli to check the sensory pain, demonstrated that the higher the alexithymic "difficulty identifying feelings",

the higher the participants' perceived pain, but not the sensory pain. Controlling for the psychological distress negated the significance of these findings. However, "difficulty describing feelings" continued to predict the levels of hypochondriasis even after the psychological distress and affective pain were controlled for. Hypochondriasis is a condition where a person is convinced they have an illness, despite medics' reassurances that there is none.

Van Middendorp et al. (2008) noted that those participants with FMS who struggled to describe their feelings and were more inclined to avoid dealing with emotions, rather than attempting to process them, were more distressed, and perceived their pain as stronger. They reported that people with FMS had a higher tendency for emotional avoidance, and experienced less positive emotions than HC. They suggested that focusing on improving affective functioning of people with FMS in therapy, through targeting the ability to identify and describe feelings, might improve their perception of pain. In line with this idea, Greenen et al. (2012) reported that high emotion expression weakened the positive correlation between high psychological distress and the FMS symptoms. In other words, women who expressed their emotions felt their FMS symptoms less intensely. Interestingly, the alexithymic difficulty with identifying and describing feelings did not cause additional distress for women. Neither was the FMS impact reduced through cognitive reappraisal, which is a technique helping to regulate the emotional response by reinterpreting the meaning of emotions. However, for women with FMS who experience their emotions intensely and in whom the impact of FMS is high, expressing emotions can be beneficial, suggesting that an emotional expression or disclosure intervention may aid adjustment to FMS.

**Summary**

Overall, the majority of the reported findings (nine out of 12 studies) suggest that the prevalence of alexithymia in the population with FMS is significantly higher than in other

pain conditions or the general population. The studies vary in their conclusions regarding the relationship between social cognition and FMS being, or not being mediated by psychological distress. Three studies (Greenen et al., 2012; Sayar et al., 2004; Weiβ et al. 2013) argued that the relationship between FMS and social cognition is independent of psychological distress. It is important to note however, that all of them had relatively small sample sizes; therefore it is difficult to generalise these results. Four studies (Huber et al. 2009; Pedrosa Gil et al., 2008; Tuzer et al., 2011; Steinweg et al., 2011) demonstrated that this relationship becomes insignificant when psychological distress is controlled for. The remaining five studies did not specifically comment on a possible mediation function of psychological distress. Nevertheless, the evidence points towards the significance of the relationship between alexithymia in FMS and comorbid psychological distress. Because of the small number of studies and conflicting results, further exploration of the relationship between the FMS and social cognition, as well as the psychological distress as a possible mediator is needed.

Only two studies reported recruiting male participants (Bartley et al, 2009; Steinweg et al., 2011), which makes it difficult to generalise the findings to both male and female sufferers of FMS. Although the majority of the population with FMS consist of women (a nine to one ratio) it is important to recognise that men may be experiencing FMS in a different way to women. There is a need to consider this in future research.

## The relationship between FMS and Attachment

The interest in research into the relationship between attachment and functional somatic disorders is vast. However, studies focusing specifically on attachment styles in FMS are still very few. Although there is a close link between trauma and insecure attachment, as mentioned earlier, due to the constraints of this doctoral research, this review focuses only on papers directly exploring attachment and FMS.

**Prevalence of insecure attachment in FMS**

All the selected studies (Govender, Cassimjee, Schoeman, & Meyer, 2009; Griffies, 2010; Hallberg, & Carlsson, 1998; Kratz, Davis, & Zautra, 2012; Oliveira & Costa, 2009; Pedrosa Gil et al., 2008) described the existence of a significant relationship between FMS and attachment. Govender et al. (2009) and Kratz et al. (2012) reported that insecure attachment was prevalent in around 41% of the population with FMS. Kratz et al. (2012) used a mixed sample of FMS and osteoarthritis (OA) patients, and presented their data only using a mixed FMS/OA group. Nevertheless, given that they found no significant differences between the two groups in distribution of attachment styles, it is safe to assume that the rate of around 41% prevalence of insecure attachment was also present in the FMS group. Both of the above studies explored insecure attachment using a two dimensional model of attachment: avoidance and anxiety. Interestingly Govender et al. (2009) showed that attachment anxiety was lower in the population with FMS compared to the general population. However, attachment avoidance was significantly higher in the FMS group. These findings were supported by Kratz et al. (2012) who reported that 74.8% of the clinical population scored low on the attachment anxiety dimension, and only 25.2% scored in the high range. Kratz et al. (2012) also showed that 44.3% of the clinical population scored high, and 55.7% scored low on the attachment avoidance. Those who had high attachment avoidance described more pain intensity and pain catastrophising, compared to those low in avoidance. As could be expected, those with high avoidance also described lower mean of social coping. The significant differences in perception of pain intensity, pain catastrophising and social coping were related only to the attachment avoidance and not the attachment anxiety. Govender et al. (2009) additionally reported that those participants with FMS who had an insecure attachment style were also more prone to depression, hopelessness and negative attribution characteristics compared to those with secure attachments.

Although it is important to note that not all people with FMS have insecure attachment styles, those who do, tend to avoid close relationships. This was also confirmed by Hallberg and Carlson (1998), who reported that there are differences in the amount of significant relationships built in the general population compared to the population with FMS. Women with FMS tend to have only one or two close relationships, usually with their romantic partner and a close friend. In the general population it is more common to have between six and 11 significant relationships. It is therefore important to consider this tendency to avoid closeness, when considering patients' involvement in treatment and building trust between the clinician and the person with FMS.

**Attachment and symptom reporting**

Oliveira and Costa (2009) explored associations between attachment, health status, and worrying. They noted that insecure attachment was associated with higher reported rates of both physical and psychological symptoms of FMS. They used a Portuguese self-report measure, Romantic Attachment Questionnaire (Matos & Costa, 2001), developed on the basis of Bartholomew and Horowitz's (1991) concept of attachment. The results were described using four dimensions of attachment: trust, dependence, ambivalence and avoidance. According to Oliveira (2008) a secure attachment is characterised by high levels of trust, and low levels of ambivalence, dependence, and avoidance. A preoccupied style is characterised by high levels of confidence and dependence, and low levels of ambivalence and avoidance. A fearful style is defined by high levels of dependence, ambivalence and avoidance, and low levels of trust. Finally, a dismissing style is described by high ambivalence and avoidance, and low trust and dependence. Oliveira and Costa (2009) reported that the higher the FMS symptoms, the higher the dependence dimension of attachment, as well as worrying. They also noted that worrying mediated the relationship between attachment dependence and both FMS symptoms and psychological distress.

**Development of insecure attachment in fibromyalgia**

Hallberg and Carlsson (1998) interviewed 22 women with FMS. In developing their grounded theory study they collated the interview data of patients' experiences of FMS and divided them into different categories. They described a core concept of "psychosocial vulnerability". It was suggested that this core concept contained four basic categories: "traumatic life history" (which is linked to early attachment experiences), "over-compensatory perseverance", "pessimistic life view", and "unsatisfying work situation". When these experiences interact over time, they add to the development of chronic pain in FMS. Their data showed that the majority of women with FMS had complicated or chaotic life histories including repeated traumatic experiences. They suggested that women with FMS developed insecure attachments through having their attachment behaviours frustrated during infancy. It was very common for them to experience:

- Early loss (losing a parent due to death, divorce, or adoption/relocation due to war, or losing a child- all these contributing to high levels of separation anxiety and feelings of rootlessness);
- Being burdened with high responsibilities early in life (being fostered for labour purposes, caring for younger siblings, housekeeping, starting work while still being at school);
- Social problems (in the primary family: alcohol abuse, violence, psychiatric illness);
- Helplessness and powerlessness (feelings of having no control over what is happening to them, and no power to defend themselves).

Their insecure attachment often manifested in adulthood through ambivalent interactions between help-seeking and withdrawal, so called doctor shopping (Mikail, Henderson, & Tasca, 1994). Howell (1994) additionally noted that when negative and

distrusting patterns of communication dominate between a health professional, or a significant other, and the person with chronic pain, a progression towards illness occurs.

The two remaining studies (Griffies, 2010; Pedrosa Gil et al., 2008) described how insecure early attachment with the primary caregiver can lead not only to development of FMS but also poor social cognition. Pedrosa Gil et al. (2008) reported that the alexithymic difficulty with identifying feelings was significantly correlated not only with FMS symptomatology (as described earlier) but also with parental style. Indifference in parental style of either of the parents was positively correlated with poor social cognition even when the FMS symptom severity or psychological distress was controlled for. Also mother's abusive style of parenting increased the difficulties with identifying feelings for people with FMS. Trying to understand the reasons for parental harmful behaviour can be highly threatening to the developing child; therefore, it might be better (safer) for him/her to cut off their mentalization activity (Fonagy, György, Elliot, & Target., 2002).

Griffies (2010) described a single case study of a man with FMS who has attended psychoanalysis several times a week for six years. Using the example of his client- Mr W., Griffies argued that experiencing stress and trauma in early life, conditions the development of neurobiological stress regulatory systems in our brains. Conditioning of these systems in infancy is responsible for how we will respond to stress later in life. The stress regulatory systems work automatically and maintain the homeostasis of our bodies and minds. As a baby, on a sensorimotor level, Mr W. was unable to conform to his mother's rigid needs. In the preverbal stage, he naturally showed his distress only through his body movement and through crying. In reaction to the distress, his mother might have felt that Mr W. was uncooperative, insulting or rejecting. Additionally she felt unconfident in providing any reassurance. Rather than soothing him, she responded by tensing her own body and retaliated by domination or abandonment. Subsequently, Mr W. was unable to secure an attachment

with his mother, and learned that his body was distressful and bad. Later in his life, any level or quality of body arousal was interpreted by his subcortical stress and pain processing networks as painful and threatening. Staud (2002) suggested that when the nervous system is chronically receiving aversive stimulation, it eventually begins to generate its own pain centrally, without external stimuli.

Griffies (2010) argued that when a developing child learns from his primary caregiver that his/her own emotions are posing too great a threat to their relationship with their attachment figure, their subcortical neural networks learn to inhibit the affect before it can be symbolized. As a consequence, the development of the mental self (mentalization) is blocked. In such situations, those who are insecurely attached might not know their own thoughts, feelings, beliefs, and ideas, and feel quite lost, and take on "false self-representations" (Winnicott, 1965). For mentalization ability to develop appropriately in a growing child, the caregiver needs to recognise the baby's needs and emotions, and respond accordingly by sharing joys, or offering comfort and support when needed. If however, the parent responds in a conflicting manner, the baby will identify with the incorrectly mirrored affect observed in the parent's face, and might begin to develop a false, or in other words "alien self" (Fonagy et al. 2002). Some people integrate their false-selves so thoroughly that any psychological distress is unconsciously completely ignored, except for the painful somatic symptoms, which are impossible not to notice. In other words, the capacity to mentalize body and affect requires a secure attachment (Griffies, 2010).

**Summary**

Insecure attachment, especially attachment avoidance and dismissing parental style are positively correlated with FMS symptomatology. Not all, but nearly half of the population with FMS do develop insecure attachment styles (Govender et al., 2009; Kratz et al., 2012). Govender et al. (2009) showed that avoidant rather than anxious attachment was

more prevalent in the population with FMS. Kratz et al., (2012) additionally observed that those with avoidant attachment were less likely to seek social support. This could explain the observation that people with FMS often rely only on one or two significant people in their lives, rather than six to 11 as noted in the general population (Hallberg & Carlson, 1998). It is widely known that there are strong links between social isolation and depression/psychological distress. Govender et al. (2009) also observed this, reporting that the insecure attachment in the population with FMS was significantly related to psychological distress. Oliveira and Costa (2009) furthermore noted that the more pain people experienced, the more their dependent attachment style was activated, and their dependency was additionally increased by worrying. On the other hand, the more insecure a person's attachment style was, the worse their perception of pain intensity and the higher the tendency to catastrophize (Kratz et al., 2012).

Often those patients with FMS, who had insecure attachments, developed them through experiences of chaotic early childhoods, and often traumatic events (Hallberg & Carlson, 1998). Their insecure attachment style was frequently manifested through ambivalence between seeking and avoiding help from clinicians. Griffies (2010) and Pedrosa Gill et al. (2008) reported that insecure attachment also limited the development of social cognition, the ability to identify feelings, and to mentalize one's own physical states. Without being able to recognise what one feels, it is much harder to know what kind of help one might need, and where to seek it.

The early life trauma also conditions the way the neurobiological pathways (HPA axis) will respond and regulate stress later in life (Griffies, 2010). The subcortical stress and pain networks learn to interpret body arousal as painful and threatening, and eventually can begin to generate its own pain centrally, without external stimuli (Staud, 2002).

## Limitations of the cited research

All the quantitative studies (all apart from Griffies, 2009; and Halberg & Carlson, 1998) have used correlational analyses, which do not allow inferring about line of causation. A potential limitation to these studies was also the use of self-report questionnaires, which measure subjective pain and mood ratings, and which give the opportunity for those more distressed participants to rate their symptoms as more severe. Although qualitative studies can partially address this by adding more observations from the researcher, both types of symptoms are indeed very subjective and therefore difficult to measure in any other than a subjective way.

A common limitation found across the studies on FMS and social cognition was a significant lack of social cognition measures other than TAS (Taylor et al., 1988). Although it is a widely used and validated measure, which allows comparison of results across studies, it is important to test out whether these results would be similar using other measures of social cognition.

Out of 17 studies selected for analysis all together, as many as eight (47%) have not used a control group (Castelli et al., 2012; Greenen et al., 2012; Govender et al., 2009; Griffies, 2010; Hallberg & Carlson, 1998; Huber et al., 2009; Oliveira & Costa, 2009; Pedrosa Gil et al., 2008). Only three studies (Sayar et at., 2004; Steinweg et al., 2011; Tuzer at el., 2011) used both a healthy control group and another group suffering from a pain related condition. There is a need for different control groups, in order to assess whether the findings are unique to populations with FMS, or whether they may be generalised to other chronic pain conditions.

Small sample size in all but five of the studies (Huber et al., 2009; Kratz et al., 2012; Penacoba Puente et al., 2013; Tuzer et al., 2011; Van Middendorp et al., 2008) significantly reduced the strength of the findings. Also, only four studies (Bartley et al., 2009; Govender

et al., 2009; Griffies 2009; Steinweg et al., 2011) used male participants, and their numbers were less than eight percent of the total sample. This makes it impossible to generalise the results across both genders. Worth considering is that these studies recruited participants with FMS mainly from clinical settings rather than a representative cross-section of the population. It is possible that a selection bias occurred where those recruited have been more anxious or depressed than other people with FMS functioning in the community without much input from specialists. It would however, be even more difficult to recruit sufficient numbers of participants with FMS from the general population, in order to overcome a possibility of such selection bias.

## Implications for clinical practice

Based on these findings it is clear that FMS is highly correlated with insecure attachment and poor social cognition. It is however, important to stress that not all FMS sufferers have developed either of them. Therefore, it is crucial to treat every patient on an individual basis and to perform a thorough assessment. Not everyone with FMS needs, or would benefit from psychotherapeutic work. For some, pycho-education and learning about pain/fatigue management is the most helpful and sufficient psychological intervention. When working to establish a good clinical relationship with a patient it is always important to create a safe and holding environment. It is especially important when working with those patients who struggle to recognise and describe their own feelings. Improving social cognition abilities might help some individuals express their feelings more and subsequently reduce their psychological distress, and FMS symptoms. However, more studies are still needed to explore what treatment type and focus would be most beneficial in such circumstances.

## Future research

As nine times more women than men live with FMS, the research so far mainly focuses on female participants (see appendix 2 and 3). This however, significantly limits the

generalisation of results across genders. More studies are needed to explore whether there are differences in the experience of FMS between men and women.

All of the research found on the relationship between FMS and social cognition or attachment has been conducted outside of the UK. In order to inform NHS clinical services, it is important to ascertain whether the results found in other countries are also confirmed in the UK.

Studies exploring social cognition in FMS used mainly Toronto Alexithymia Scale. It is important to test whether similar results are found using different measures of social cognition, i.e. RMET (Baron-Cohen et al, 2001), Movie Assessment of Social Cognition (Dziobek, et al., 2006) or Stone, Baron-Cohen, and Knight's Faux Pas Test (1998).

As not many studies explore whether the relationship between social cognition and FMS is independent of psychological distress, it is important to consider this mediation in future research. Studies attest to the relationship between FMS and social cognition, as well as attachment. Some studies additionally report links between attachment and social cognition (Griffies, 2010; Pedrosa Gil et al., 2008). So far; however, there is still a gap in the literature looking at both attachment and social cognition in FMS. Griffies (2010) argued that an insecure relationship between the primary care giver and a growing child, can inhibit the development of social cognition. The need to block the recognition of one's own feelings can in turn lead to neglect of body affect. Therefore it would be interesting to explore whether social cognition mediates the relationship between attachment and FMS.

The strong support for the relationship between poor social cognition and FMS also invites more research to test whether improving social cognitive abilities would reduce FMS symptomatology. It would also be interesting to find out whether any specific type of intervention to improve social cognition works better than another intervention in the population with FMS.

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**Karolina Oracz**

MAJOR RESEARCH PROJECT

**SECTION B**

**EMPIRICAL PAPER**

# The relationship between adult attachment style and fibromyalgia symptoms as mediated by social cognition.

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**Abstract**

**Objectives:** This study aimed to determine whether there are significant relationships between fibromyalgia syndrome (FMS), social cognition, and adult insecure attachments. It was hypothesised that social cognition would mediate the relationship between insecure attachment styles and FMS.

**Design:** A quantitative, cross-sectional design was employed to compare experiences of 105 individuals with fibromyalgia and 172 healthy controls (HC). A correlation and mediation analyses were used to explore relationships between insecure attachment, social cognition, and FMS symptoms. Data were obtained via self-report measures filled-in either in a paper form or via an on-line questionnaire.

**Results:** The relationships between anxious and avoidant attachment styles and FMS were confirmed. The significance of the relationship between social cognition and FMS varied depending on the measure used. When ability to recognise emotions in others was tested (Reading the mind in the eyes test) there were no significant differences between FMS and HC. However, the mentalization measure- Reflective Function Questionnaire, which additionally tests the ability to recognise one's own feelings, showed a significant relationship with FMS. The relationship of FMS with both insecure attachment styles as well as with mentalization were strongly mediated by psychological distress. Social cognition was not shown to mediate the relationship between insecure attachment and FMS.

**Conclusions**: Although causality cannot be inferred, psychological distress was strongly related to FMS and significantly influenced the way FMS symptoms relate to insecure attachment and poor social cognition. Implications for clinical practice and future research are discussed.

**Key terms**: fibromyalgia, functional somatic disorder, adult attachment, social cognition, mentalization, theory of mind, alexithymia, psychological distress.

## Introduction

There is a wide interest in the way trauma in early life and attachment style influence onset, utilization of health care, and prediction of recovery from functional somatic disorders such as fibromyalgia syndrome (Hammill, 2010; Lumley, 2011; Luyten & Van Houdenhove, 2012; Mayer, 2000). Not all people who experienced trauma as children, go on to develop insecure attachments (Fonagy, Steele, Steele, Moran & Higgitt, 1991) and/or chronic pain (Van Houdenhove, Luyten & Van Den Eede, 2008). It is therefore possible that some additional factor is indirectly determining whether negative early life experiences are perceived as so stressful that the body's immune system becomes overloaded, unable to process the stress signals, and subsequently manifests those signals through physical pain. Fonagy et al. (1996) suggested that social cognition (mentalization) acts as a mediator of early attachment experiences in the development of later psychological difficulties. Luyten and Van Houdenhove (2012) have extended mentalization theory from psychopathologies to physical health problems. The present study looks to further explore whether social cognition mediates the relationship between fibromyalgia and attachment.

### What is fibromyalgia

Fibromyalgia syndrome (FMS) is a complex disorder that is characterised by widespread chronic pain, extreme fatigue, disrupted and unrefreshed sleep, difficulties with the digestive system, as well as cognitive and memory problems (Glass, 2006; López-Pousa et al., 2013; Wolfe et al., 1990). Although similar to arthritic pain, FMS does not cause damage or inflammation of the joints, muscles, or other tissues (Wright, 2011). The combination of symptoms often significantly impairs activities of daily living. It affects two to four percent of the worldwide population, mainly women (nine to one ratio), and is most common in the 20-50 age group (Wolfe et al., 1995). It belongs to a group of disorders sometimes called functional somatic disorder (FSD), and unfortunately to date, there is no

clear aetiology or cure for it. Researchers suggest that in FMS, an intensive physical or psychological distress can cause the hypothalamic-pituitary-adrenal axis (HPA) - an essential neuroendocrine stress regulation system, to switch from the state of "under-drive" into "overdrive". Subsequently, inflammatory activity is exacerbated and the brain perceives pain whereas before it would only interpret such signals as uncomfortable or stiff (Clauw, 1995; Van Houdenhove & Luyten, 2007).

Studies attest to the relationship between chronic pain in general and insecure attachment (Davies, Macfarlane, McBeth, Morriss, & Dickens, 2009; Meredith, Ownsworth, & Strong, 2008; Mikail, 2003; Oliveira & Costa, 2009), but the literature exploring connections between FMS and attachment is still scarce.

**Attachment theory**

Bowlby's theory of attachment (1969/1979) proposed that the way the primary caregiver responds to one's needs, especially during the first 24 months of the infant's life, influences how she/he will expect others to respond to their needs in the future, and behave accordingly. Hazan and Shaver (1997) suggested that those who have a secure attachment are able to form long-term, trusting relationships with significant others, share feelings and seek social support when needed, while retaining high self-esteem. Insecure attachment, on the other hand, can be described using a two dimensional model of anxiety and avoidance. They suggested that an anxious attachment style is developed as a result of an infant enduring inconsistent and intrusive care from their primary care giver. They might excessively seek reassurances from their partner due to fear of abandonment. If, however, one meets with "cold", rejecting, or neglectful care, as adults they might be prone to developing an avoidant attachment. This could manifest in mistrusting others and feeling excessively uncomfortable with intimacy and dependence on others (Oliveira & Costa, 2009).

**The relationship between fibromyalgia and attachment**

A significant percentage of the population with FMS reports higher than average rates of childhood abuse and victimisation, experiences which often accompany insecure attachment status (Häuser, Kosseva, Uceyler, Klose & Sommer, 2011). Such sustained stress can have long lasting effects on the body's immune system as several psychoneuroimmunology studies attest (Kendall-Tackett, 2009). Insecure attachment rates can be as high as 41% amongst FMS patients (Govender, Cassimjee, Schoeman, & Meyer, 2009; Kratz, Davis, & Zautra, 2012). Govender et al. (2009) showed that avoidant, rather than anxious, attachment is particularly prevalent in this group. Kratz et al., (2012) additionally observed that those with avoidant attachment were less likely to seek social support. Similarly, Hallberg and Carlson (1998) reported that people with FMS often rely only on one or two significant people in their lives, rather than six to 11 as observed in the general population. This is a very important observation, considering that strong links between social isolation and depression/psychological distress are widely recognised. Therefore, Govender et al.'s (2009) finding that insecure attachment in the population with FMS was significantly related to psychological distress is not surprising.

Often those patients with FMS who have insecure attachments developed them through chaotic early childhood experiences, often involving traumatic events (Hallberg & Carlson, 1998). Their insecure style frequently manifests through ambivalence between seeking and avoiding help from clinicians.

Early life trauma also conditions the way the neurobiological pathways (HPA axis) respond and regulate stress later in life (Griffies, 2010). The subcortical stress and pain networks learn to interpret body arousal as painful and threatening, and eventually begin to generate their own pain centrally, without external stimuli (Staud, 2002).

Griffies (2010) and Pedrosa Gill et al. (2008) reported that insecure attachment also limits the development of social cognition, the ability to identify feelings and to mentalize one's own physical states. Without being able to recognise what one feels, it is much more difficult to know what kind of help one might need, or where to seek it.

**Social Cognition**

The term social cognition is used here as an umbrella term for theory of mind, mentalization, and alexithymia, as they are closely linked with each other. Theory of mind is the ability to attribute mental states, beliefs, needs, intents, and desires to oneself and others. It requires the understanding that others have beliefs, desires and intentions different to one's own, and therefore this ability helps us to predict or explain other people's actions, and to posit their intentions (Baron-Cohen, 1989; Premack & Woodruff, 1978). Bateman and Fonagy (2004) named the mental process of interpreting one's own and others' mental states as mentalization. Additionally to mental states, mentalization encompasses affect, consciousness, and addresses social cognition of both "self" as well as "others".

The lack of the ability to identify and describe feelings due to deficits in cognitive processing and affect regulation is called alexithymia (Kooiman, Bolk, Rooijmans & Trijsburg, 2004). Research shows that people with alexithymia often present with somatic symptoms (Lesser, 1985). Because of the theoretical similarities between theory of mind, mentalization, and alexithymia, and until recently a lack of a validated mentalization measure, much of the published research focused on assessing social cognition using the Toronto Alexithymia Scale (TAS; Taylor et al. 1988).

**Fibromyalgia and Social cognition**

Overall, studies suggest that the prevalence of alexithymia in the population with FMS is significantly higher than in other pain conditions or the general population. Studies vary however, in their conclusions about whether the relationship between social cognition

and FMS is direct (Sayar, Gulec, & Topbas, 2004; Greenen et al., 2012; Weiβ, Winkelmann, & Duschek, 2013) or mediated by psychological distress (Huber et al. 2009; Pedrosa Gil et al., 2008; Tuzer et al., 2011; Steinweg et al., 2011), with a small advantage towards the latter. The evidence of an existing relationship between alexithymia in FMS and comorbid psychological distress is nevertheless strong, and hence there is a need for further exploration of these relationships.

## Rationale for the current study

Poor early attachment relationships, where the individual has not been exposed to a caregiver's sensitive modelling of awareness of internal mental states in the self or in others, may lead to impaired mentalization or poor social cognition (Bateman & Fonagy, 2004). The individual may therefore, tend to concretise his/her experiences and understand them in terms of the body (somatic complaints) rather than thoughts and feelings. Furthermore, the poor ability to regulate mental states may lead to greater stress on the HPA axis, which in turn physiologically increases chances of developing FMS (Clauw, 1995; Van Houdenhove & Luyten, 2007). This finds confirmation in research showing that patients with functional somatic disorders tend to misinterpret their own emotional signals as bodily sensations (Subic-Wrana, Bruder, Thomas, Lane, Köhle, 2005) and have a deficit in general theory of mind (Subic-Wrana, Buetel, Knebel & Lane, 2010).

Van Middendorp et al. (2008) noted that people with FMS who struggled to describe their feelings and were more inclined to avoid processing emotions, were more distressed, and perceived their pain as stronger. It is arguable that mentalization ability can help to overcome the effects of early life stresses and help the individual become more resilient (Fonagy & Target, 1997). Individuals who can identify and talk about their own and others' inner states may be able to better process and therefore neutralise these noxious experiences. Greenen et al. (2012) reported that women who expressed their emotions felt their FMS

symptoms less intensely. Van Middendorp et al. (2008) suggested that focusing on improving affective functioning of people with FMS in therapy, through targeting the ability to identify and describe feelings, might improve their perception of pain.

It has been suggested that attachment status alone does not predict illness severity (Van Houdenhove, Luyten, Van den Eegle, 2008), nor does poor mentalization independently cause FMS, as not everyone with poor social cognition develops this disorder. Further insight into the links between FMS, social cognition, and attachment will improve the understanding of the underlying mechanisms of FMS and inform treatment options. Therefore, this project aimed to further explore the correlation between adult attachment style and FMS, proposing social cognition as a mediating factor.

**Research hypotheses**

1. Participants with fibromyalgia syndrome will have a different prevalence of insecure attachment styles, and different levels of social cognition ability compared to Healthy Controls.
2. Adult insecure attachment style and social cognition will be correlated with FMS symptomatology.
3. Relationships between FMS and social cognition, and FMS and insecure attachment will not be mediated by psychological distress.
4. The relationship between insecure adult attachment styles and FMS symptoms will be mediated by social cognition.

## Methods

### Design

A quantitative, cross-sectional design was employed to compare experiences of individuals with FMS and healthy controls (HC). A correlation and a mediation analysis

were used to explore relationships between insecure attachment, social cognition, and FMS symptoms.

**Participants**

A total of 277 English speaking adults, 18 years of age or above, were recruited for this study. The clinical sample (participants with FMS) of 105 were required to have a confirmed diagnosis of FMS by a rheumatologist. Patients with FMS were recruited via three NHS outpatient rheumatology clinics across the South East of England. Healthy controls (172 participants) were recruited from university, hospitals, local community environments and a social networking site. They were required to have never received a diagnosis of any functional somatic disorder. People working in the fields of psychological therapy or psychiatry were excluded because these roles involve high social cognition skills, which were expected to be higher than in the general population. Being actively suicidal or psychotic were also exclusion criteria for both groups.

**Ethical considerations**

Approval was obtained from an NHS Research Ethics Committee (REC) (see Appendix 4). Authorisation was also obtained from Research and Development (R&D) Departments at each of the study sites (see Appendix 5). During the REC meeting several issues were discussed, including: the possibility of psychological distress and appropriate response from the researchers and clinicians; physical tiredness due to length of the questionnaire; recruitment methods; and confidentiality. Written, informed consent was obtained from all participants following the British Psychological Society's (2010) research ethics guidelines. All data were stored in accordance with Caldicott Principles (Department of Health; DOH, 2003) and guidance outlined in the British Psychological Society's (BPS) Code of Ethics and Conduct (BPS, 2010).

**Sample size requirements**

The sample size calculations were conducted using G*Power a priori analysis (Faul, Erdfelder, Lang, & Buchner, 2007). It was assumed that only three predictor variables would be included in the regression and mediation analysis. The results showed that for the regression analyses an overall sample size of 68 was necessary to achieve a high level of power ($\beta = 0.80$) with statistically significant results ($p < 0.05$; two-tailed) when the effect size is moderate ($r = 0.3$; Cohen, 1988; Bonnett & Wright, 2000). Independent t-test required a minimum of 64 participants in each group.

**Procedure**

The participants with FMS were identified by their clinicians in the rheumatology clinics at each of the recruitment sites. They were informed about the study taking place either by their clinician during the routine visit to the clinic, or via phone by the main researcher. Participants were encouraged to ask questions, and if they verbalised interest in taking part in the study a paper or electronic survey version of the questionnaire pack including an invitation letter (see Appendix 6), detailed information sheet (see Appendix 7), a consent form (see Appendix 8), and the questionnaire battery (see Appendix 9) were sent to them either via post, or via e-mail. If they requested a paper version of the pack, then a return stamped envelope was included in the pack. HC group participants were approached via university e-mail addresses among staff and students, also clinical and non-clinical hospital staff, local community centres, and a social networking site. A small incentive for taking part, in the form of a £40 Amazon voucher draw, was offered to all participants. Written consent was then obtained from each participant, following which five self-report measures were completed (see Appendix 9). The questionnaires between FMS and HC groups differed only on the fibromyalgia impact questionnaire where fibromyalgia symptoms term was

substituted with physical symptoms. The process of filling in the complete questionnaire pack was estimated to take roughly between 30-45 minutes.

Data were anonymised through the use of participant identification numbers and stored securely. The consent forms, which contained the contact detail if a participant wanted to take part in the prize draw, were kept separately from the questionnaire pack, and at the end of the study, along with electronically identified e-mails, used in the prize draw. The winning participant was contacted by the main researcher to request the address to which they wished the voucher to be sent to.

**Measures**

**Fibromyalgia.** Fibromyalgia symptoms were measured by the Fibromyalga Impact Questionnaire - Revised (FIQ-R; Bennet, Friend, Jones, Ward, Han & Ross, 2009). The FIQ-R comprises 21 items where the respondent indicates how difficult it is to complete various tasks on an 11-point visual analogue scale ranging from no difficulty to very difficult. For the purpose of this study the scale has been transformed to a continuous 0-10 Likert scale. Individual item scores were summed to obtain an overall score, with a possible range from 0 – 210. Higher scores indicated greater intensity of fibromyalgia symptoms.
The FIQ-R has been cited in over 300 empirical studies and has been shown to possess good construct validity (ibid.). In the current study, internal consistency of the scale was found to be excellent (Cronbach's $\alpha$ = .98 for the total sample; $\alpha$ = .95 for the FMS only; and $\alpha$ = .93 for the HC only).

**Social cognition**

**Mentalization.** Participants' ability to mentalize was assessed via a self-report measure -the Reflective Function Questionnaire (RFQ54; Fonagy & Ghinai, unpublished manuscript; Moulton-Perkins & Rogoff, 2011). It provides an operationalised quantitative measure of the capacity for mentalizing. Questions were scored on a scale between one and

seven. The questionnaire is scored by two methods: 22 items are based on polar scoring, where scores of one or seven indicates high mentalization, and a score of four means low mentalization; and 32 items are based on median scoring, where a score of four means high mentalization. The sum of all the scores, with a possible range from 54 – 378, gives a total value of mentalization. This measure is still undergoing a process of validation. An earlier, shorter version of the RFQ with 46 items was validated on a sample including people with eating disorders (Perkins, 2009). The RFQ46 was reported to have good reliability ($\alpha$ = 0.69), and good construct validity based on being positively related to theory of mind, empathy, and mindfulness, and inversely related to depression, multi-impulsivity, disordered eating, and borderline symptoms (ibid.). A further eight items have been added since to form the RFQ54. As this measure is still in the process of validation, information on its reliability is somewhat limited; however its preliminary validity was shown in three studies (Perkins, 2009; Rogoff, 2011; Wilshere, 2011). Cronbach's $\alpha$ of the RFQ54, in the current study, was 0.84 for the total sample, 0.87 for the FMS and 0.82 for the HC populations.

**Theory of mind.** The Reading the Mind in the Eyes Test' (RMET; Baron-Cohen, Wheelwright, Hill, Raste & Plumb, 2001) was included in the study in order to provide an appraisal of differences in social cognition and emotion recognition across clinical and non-clinical groups. Within this test, participants are asked to infer mental states from a series of 36 photographs depicting eye regions. The answer is chosen from four provided options, where only one is correct. The higher the total score, the higher the social cognition.

### Attachment

The Experiences in Close Relationships Questionnaire – Revised (ECR-R; Fraley, Waller & Brennan, 2000) measures attachment-related anxiety (i.e. the extent to which a person is insecure about the responsiveness of others) and attachment-related avoidance (i.e. the extent to which a person is uncomfortable being close to others). This self-report

scale comprises 36 statements rated on a one to seven scale from strongly disagree to strongly agree. Individual items are summed to yield scores across two subscales; attachment-related anxiety (possible range: 22 -154) and attachment-related avoidance (possible range: 14-98). Within the current study sample, internal consistency of the anxiety (Cronbach's $\alpha$ for the total sample = 0.93; for the FMS sample $\alpha$ = 0.92; for the HC sample $\alpha$ = 0.93) and avoidance subscales (Cronbach's $\alpha$ for the total sample = 0.89; for the FMS sample $\alpha$ = 0.85; for the HC sample $\alpha$ = 0.90) was found to be excellent.

**Psychological distress**

The Depression, Anxiety and Stress Scale (DASS; Lovibond, S. & Lovibond, 1995) comprises 14 self-report items divided into three sub-scales of between two and five items. The depression scale assesses feelings of dysphoria and anhedonia, while the anxiety scale provides an appraisal of autonomic arousal. The stress scale explores non-specific arousal (e.g.: irritability or impatience). Responses to individual items are rated using a four-point scale (ranging from zero to three). Subscale scores are obtained by summing scores on relevant items. The DASS has demonstrated good psychometric properties across a variety of settings and populations (Antony, Bieling, Cox, Enns & Swinson, 1998). Internal reliability across the three sub-scales was excellent in the present study (for the total sample Depression $\alpha$ = 0.89, Anxiety $\alpha$ = 0.96, Stress $\alpha$ = 0.96, total distress $\alpha$ = 0.98; for the FMS sample: Depression $\alpha$ = 0.97, Anxiety $\alpha$ = 0.92, Stress $\alpha$ = 0.94, total distress $\alpha$ = 0.97; for the HC sample Depression $\alpha$ = 0.94, Anxiety $\alpha$ = 0.92, Stress $\alpha$ = 0.94, total distress $\alpha$ = 0.97).

**Analyses**

Data were analysed with IBM SPSS (version 21). Data were first screened for out-of-range and missing values. Subscales with missing values were excluded pair-wise from analyses. Assumptions underlying parametric statistics were explored. Normality of

distributions were explored using histograms, skewness, kurtosis and Kolmogorov-Smirnov tests. Levene's tests were used to explore the assumption of homogeneity of variance.

Correlations were explored with Pearson's product moment coefficients (r) for parametric data or Spearman's rho for nonparametric data. Correlations were conducted two tailed. As not all measures met the requirements for parametric statistics for each group, a further bootstrapping technique was performed. It allows an estimation of sampling distribution, by taking repeated samples from the sample data (Efron & Tibshirani, 1993).

Bootstrapped mediation analysis with bias-corrected and accelerated (BCa) 95% and confidence interval (CI) estimation was conducted using the Preacher and Hayes (2008) INDIRECT multiple mediation SPSS plugin. Bootstrap resampling was set to 1000 (the minimum required; Preacher & Hayes, 2008).

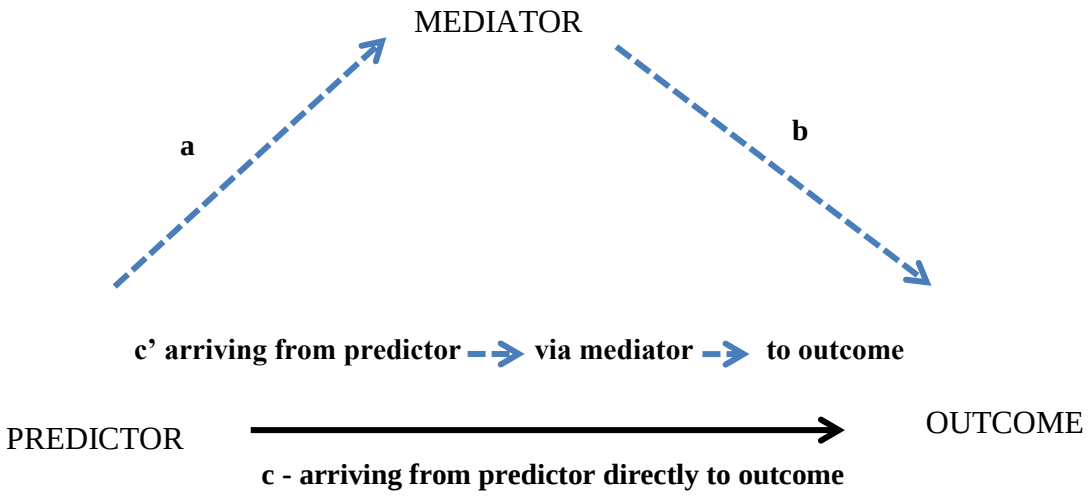
Baron and Kenny (1986) explain mediation analysis as a series of regressions:

a. The regression predicting the mediator from the predictor variable.

b. The regression predicting the outcome from the mediator.

c. The regression predicting the outcome from the predictor.

c'. The regression predicting the outcome from both the predictor variable and the mediator.




**Graph 1.** Based on Baron and Kenny's (1986) model of mediation.

According to this model a perfect mediation occurs when the regression parameter c' is smaller than c. To avoid the tendency occurring in research practice, of only comparing the statistical significance between c and c', rather than comparing the size of regression as advocated by Baron and Kenny (1986), Hayes (2013) suggested a mediation model with direct and indirect effects. He understood the relationship between predictor and outcome via the mediator as the 'indirect effect'. The direct relationship between predictor and outcome variables when the mediator is included in the model was named the 'direct effect'. Finally, the relationship between the predictor and the outcome, when the mediator is not included in the model, in other words path c from Baron and Kenny's (1986) model, was called the 'total effect'.

Preacher and Hayes' (2008) INDIRECT multiple mediation SPSS plugin gives the 95% confidence interval of the parameters, as well as confidence intervals of the indirect effect. If the confidence interval (CI) of true value (b) of the indirect effect does not include zero value, then it can be safely inferred that a genuine mediation effect has taken place.

The Preacher and Kelly (2011) Kappa squared ($\kappa^2$) was used to establish the effect size of the possible mediation effect. Attachment anxiety/avoidance scores were chosen as the predictor of FMS status, and mentalization/theory of mind measures were used as mediators for the mediation analysis.

## Results

### Demographics and sample characteristics.

Participant main demographics are summarised in Table 1. Additionally, participants with FMS (16.2%) filled the questionnaire at assessment stage, 26(24.8%) were waiting for pain management programme, and 52(49.5%) were either attending or were post FMS management programme. Seventy three (69.5%) participants with FMS and 33(19.2%) of the HCs reported to have other chronic conditions. The most common additional chronic

condition among the population with FMS was osteo-arthritis 25(23.8%), and 13(12.4%) had irritable bowel syndrome. The latter one was also present in the control group 2(1.2%).

**Table 1. Participants' demographics**

| | FMS | HC | Total Sample |
|---|---|---|---|
| Numbers | N=105 | N=172 | N=277 |
| Gender | | | |
| Male | 4 (3.8%) | 46 (26.7%) | 50 (18.1%) |
| Female | 101 (96.2%) | 126 (73.3%) | 227 (81.9%) |
| Age | | | |
| Mean | 47.01 | 34.79 | 39.42 |
| SD | 11.91 | 14.05 | 14.53 |
| Median | 48 | 32 | 38 |
| Range | 20-77 | 18-77 | 18-77 |
| Paper/on-line | | | |
| paper | 73 (69.5%) | 19(11%) | 92(33.2%) |
| On-line | 32 (30.5%) | 153 (89%) | 185(66.8%) |
| Ethnicity | | | |
| British White | 88 (83.8%) | 133 (77.3%) | 221 (79.8%) |
| Other White | 7 (6.7%) | 29 (16.8%) | 36 (13%) |
| Black/mix | 8 (7.7%) | 4 (2.3%) | 12 (4.4%) |
| Asian/mix | | 5 (3%) | 5(1.9%) |
| Missing data | | | 3 (1.1%) |
| Relationship status | | | |
| Yes | 70 (66.7%) | 107 (62.2%) | 177 (63.9%) |
| No | 34 (32.4%) | 65 (37.8%) | 99 (35.7%) |
| Missing | 1 (1%) | 0 | 1 (0.4%) |
| Length of relationship | | | |
| 0-1 years | 3 (2.9%) | 11 (6.4%) | 14 (5.1%) |
| 1-5 years | 12 (11.4%) | 34 (19.8%) | 46 (16.6%) |
| Over 5 years | 56 (53.3%) | 63 (36.6%) | 119 (43%) |
| Missing data | 34 (32.4%) | 64 (37.2%) | 98 (35.4%) |
| Education | | | |
| At least till age of 16 | 54 (51.4%) | 36 (20.9%) | 90 (32.5%) |
| Vocational training | 22 (21%) | 23 (13.4%) | 45 (16.2%) |
| University degree | 26 (24.7%) | 106 (65.8%) | 139 (50.1%) |
| Employment | | | |
| Employed | 28 (26.7%) | 86 (50%) | 114 (41.2%) |
| Unemployed | 44 (41.9%) | 4 (2.3%) | 48 (17.3%) |
| Studying | 1 (1%) | 68 (39.5%) | 69 (24.9%) |
| Retired | 13 (12.5%) | 11 (6.4%) | 24 (8.7%) |
| Homemaker | 19 (18.1%) | 3 (1.7%) | 22 (7.9%) |

The FMS and HC groups were well matched for relationship status and length, ethnicity, employment status, as well as whether they had received personal psychotherapy

and for how long (see Table 2). Data showed that there were significant differences between the two groups in the way they accessed the questionnaire (paper or online), their gender, age, highest level of education, and any other chronic conditions (see Table 2).

**Table 2. Independent Samples Test**

| | | test for Equality of Means | | t test Bootstrap[a] | | | |
|---|---|---|---|---|---|---|---|
| | | t(df) / U | Mean Difference/ z | Std. Error | Sig. (2-tailed) | BCa 95% Confidence Interval | |
| | | | | | | Lower | Upper |
| paper or online | **Equal variances assumed** | t(53) = 4.026 | MD =.460 | .109 | **.001**** | .222 | .671 |
| participant gender | **Equal variances assumed** | U = 6959.000 | Z =-4.806 | | **.000**** | | |
| age of participant | Equal variances not assumed | t(52.13) = 2.044 | MD = 7.291 | 3.531 | **.049*** | .796 | 13.742 |
| relationship status | Equal variances not assumed | t(216.68) = -.745 | MD = -.045 | .058 | .442 | -.156 | .071 |
| Length of relationship | Equal variances not assumed | t(52.99) = .770 | MD = .122 | .058 | .442 | -.156 | .071 |
| ethnicity | **Equal variances assumed** | U = 8558 | z = -1.041 | | .298 | | |
| employment status | Equal variances not assumed | t(50.57) = 2.358 | MD = 1.123 | .631 | .279 | -.162 | 2.067 |
| highest level of education | Equal variances not assumed | t(52.42) = -2.312 | MD =-.772 | .324 | **.024*** | -1.398 | -.113 |
| any other chronic conditions | Equal variances not assumed | t(51.89) = -3.009 | MD =-.380 | .127 | **.007**** | -.614 | -.149 |
| received personal psychotherapy | Equal variances not assumed | t(213.27) = -4.668 | MD = -.281 | .001 | .060 | .001 | -.402 |
| How long ago received therapy | Equal variances not assumed | U = 1778 | z = .930 | 1.972 | .249 | -2.918 | 4.488 |

### Hypothesis 1

It was hypothesised that participants with FMS will have a different prevalence of insecure attachment styles, and different levels of social cognition ability compared to HC. The bootstrapped t-test measuring variance between samples was performed (see Table 3).

On average, participants with FMS had lower levels of mentalization (M = 230.27, SE = 3.5) than HC (M =243.84, SE = 2). This difference, -13.57, BCa 95% CI [-21.714, -5.345] was significant at t(118) = -3.25, p = 0.002. Also, levels of psychological distress measured individually and as a sum of total distress differed significantly between the groups.

**Tabel 3. Differences between fibromyalgia and healthy control groups**

| | **Fibromyalgia N=70 Mean(SD)** | **Healthy Controls N=135 Mean(SD)** | **Comparison statistics T-test with bootstrap** |
|---|---|---|---|
| **Fibromyalgia (FIQ-R)** | 69.26 (19.52)<br>BCa 95% SE = 1.59 | 15.07(13.30)<br>BCa 95% SE = 1.51 | t(203) = 23.44; **p = .001****<br>MD = 54.19<br>BCa 95% CI [48.66, 59.27] |
| **Theory of Mind (RMET)** | M = 26.66 (3.44);<br>BCa 95% SE = .30 | M=26.97 (4.05);<br>BCa 95% SE = .26 | t(203) = -.55; p = .58<br>MD = -.31;<br>BCa 95% CI [-1.32, .64] |
| **Mentalization (RFQ54)** | M = 230.27(29.69);<br>BCa 95% SE = 3.07<br><br>29.5% low mentalization | M = 243.66(24.33);<br>BCa 95% SE = 1.87<br><br>15% low mentalization | t(203) = -3.46; **p = .001****<br>MD = -13.39;<br>BCa 95% CI [-21.57, -5.5] |
| **Attachment avoidance (ECR-R)** | M = 67.84(18.41);<br>BCa 95% SE = 1.56<br><br>33% high avoidance | M=58.27(19.25);<br>BCa 95% SE = .97<br><br>19% high avoidance | t(203) = 3.42; **p = .001****<br>MD = 9.57;<br>BCa 95% CI [4.04, 14.75] |
| **Attachment anxiety (ECR-R)** | M = 67.36(24.83);<br>BCa 95% SE = 1.70<br><br>28.6 % high anxiety | M = 58.57(23.30);<br>BCa 95% SE = .93<br><br>20% high anxiety | t(203) = 2.50; **p < .05***<br>MD = 8.79;<br>BCa 95% CI [1.38, 15.69] |
| **Psychological Distress (Total DASS score)** | M = 77.17(35.96);<br>BCa 95% SE = 2.53 | M = 23.40(22.08);<br>BCa 95% SE = 1.45 | t(96.72) = 11.44; **p = .001****<br>MD = 53.77;<br>BCa 95% CI [44.19, 62.44] |
| **Depression (DASS)** | M = 27.20(14.37);<br>BCa 95% SE = 1.02 | M = 6.77(7.95);<br>BCa 95% SE = .58 | t(91.46) = 11.05; **p = .001****<br>MD = 20.43;<br>BCa 95% CI [16.72, 24.20] |
| **Anxiety (DASS)** | M = 22.41(12.33);<br>BCa 95% SE = .82 | M = 5.74(7.25);<br>BCa 95% SE = .64 | t(94.40) = 10.42; **p = .001****<br>MD = 16.67;<br>BCa 95% CI [13.47, 19.67] |
| **Stress (DASS)** | M = 27.56(11.73);<br>BCa 95% SE = 1.40 | M = 10.90(9.61);<br>BCa 95% SE = .54 | t(118.08) = 10.24; **p = .001****<br>MD = 16.67;<br>BCa 95% CI [13.44, 19.58] |

The FMS group scored significantly higher on the total psychological distress measure (DASS total) (M = 77.17, SE = 4.35) than the HC (M = 23.4, SE = 1.45). This difference, 53.77, BCa 95% CI [44.17, 62.44] was significant $t(96.73) = 11.44$, $p < .001$. There were also significant differences between the groups on measures of attachment anxiety and avoidance (ECRR) with FMS group presenting more insecure attachments (see Table 3). There were no significant differences however, between the groups on theory of mind (RMET). In summary, the hypothesis was confirmed for all measures but the RMET levels, theory of mind measure.

**Hypothesis 2**

It was hypothesised that insecure adult attachment and social cognition will be significantly related to FMS. Bootstrap Pearson's correlation analyses of independent samples were conducted to see whether the variables were related to one another. The results showed that there was a highly significant negative correlation between FMS and mentalization ($r = -.24$, $p < .001$), but there was no significant relationship between FMS and the theory of mind measure. FMS was also significantly positively correlated with attachment anxiety ($r = .28$, $p < .001$) and avoidance ($r = .35$, $p < .001$), as well as with all subscales of psychological distress separately and summed together ($r = .81$, $p < .001$ ) (see Table 4).

Mentalization was significantly negatively correlated with attachment avoidance ($r = -.19$, $p = .006$), but not with attachment anxiety. Additionally it was also negatively correlated with total psychological distress ($r = -.25$, $p = .006$) and all its subscales (depression, anxiety, and stress).

Attachment anxiety was positively correlated with psychological distress ($r = .46$, $p < .001$) and all subscales of it.

Table 4. Correlations

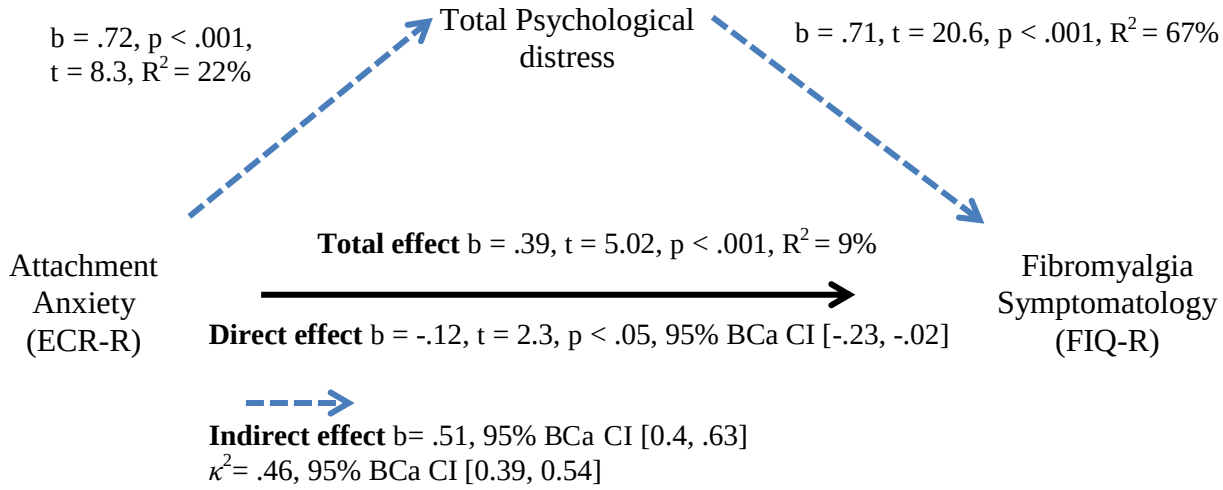
| | | | | FMS | Mentaliz. | Theory of mind | Attachment Anxiety | Attachment Avoidance | Depression | Anxiety | Stress | Psych. Distress (sum of D,A,S) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fibromyalgia Symptoms | Pearson Correlation | | | 1 | -.244** | -.068 | .284** | .352** | .791** | .782** | .722** | .807** |
| | Sig. (2-tailed) | | | | .000 | .332 | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | | | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| | Bootstrap[c] | Bias | | 0 | -.002 | -.001 | -.002 | -.005 | -.001 | -.001 | -.002 | -.001 |
| | | Std. Error | | 0 | .066 | .064 | .066 | .064 | .028 | .032 | .037 | .026 |
| | | BCa 95% Confidence Interval | Lower | . | -.369 | -.189 | .148 | .224 | .729 | .714 | .649 | .748 |
| | | | Upper | . | -.116 | .053 | .400 | .455 | .843 | .841 | .785 | .854 |
| Mentalization Total Score | Pearson Correlation | | | -.244** | 1 | .225** | -.030 | -.191** | -.245** | -.206** | -.254** | -.249** |
| | Sig. (2-tailed) | | | .000 | | .001 | .666 | .006 | .000 | .003 | .000 | .000 |
| | N | | | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| | Bootstrap[c] | Bias | | -.002 | 0 | -.001 | .001 | .003 | -.002 | -.003 | -.003 | -.003 |
| | | Std. Error | | .066 | 0 | .074 | .066 | .069 | .068 | .068 | .072 | .069 |
| | | BCa 95% C. Interval | Lower | -.369 | . | .071 | -.166 | -.335 | -.377 | -.328 | -.385 | -.376 |
| | | | Upper | -.116 | . | .365 | .105 | -.040 | -.114 | -.079 | -.121 | -.120 |
| Theory of mind total score | Pearson Correlation | | | -.068 | .225** | 1 | -.149* | -.106 | -.173* | -.114 | -.133 | -.150* |
| | Sig. (2-tailed) | | | .332 | .001 | | .033 | .132 | .013 | .102 | .057 | .032 |
| | N | | | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| | Bootstrap[c] | Bias | | -.001 | -.001 | 0 | -.002 | -.002 | -.003 | -.002 | -.001 | -.002 |
| | | Std. Error | | .064 | .074 | 0 | .070 | .070 | .068 | .066 | .071 | .069 |
| | | BCa 95% C. Interval | Lower | -.189 | .071 | . | -.282 | -.229 | -.302 | -.234 | -.261 | -.276 |
| | | | Upper | .053 | .365 | . | -.012 | .025 | -.036 | .006 | .001 | -.019 |
| Attachment Anxiety | Pearson Correlation | | | .284** | -.030 | -.149* | 1 | .401** | .438** | .425** | .457** | .464** |
| | Sig. (2-tailed) | | | .000 | .666 | .033 | | .000 | .000 | .000 | .000 | .000 |
| | N | | | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| | Bootstrap[c] | Bias | | -.002 | .001 | -.002 | 0 | -.002 | .000 | -.002 | -.001 | -.001 |
| | | Std. Error | | .066 | .066 | .070 | 0 | .056 | .053 | .055 | .054 | .050 |
| | | BCa 95% C. Interval | Lower | .148 | -.166 | -.282 | . | .289 | .321 | .316 | .340 | .360 |
| | | | Upper | .400 | .105 | -.012 | . | .503 | .541 | .531 | .557 | .556 |
| Attachment Avoidance | Pearson Correlation | | | .352** | -.191** | -.106 | .401** | 1 | .501** | .425** | .411** | .472** |
| | Sig. (2-tailed) | | | .000 | .006 | .132 | .000 | | .000 | .000 | .000 | .000 |
| | N | | | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| | Bootstrap[c] | Bias | | -.005 | .003 | -.002 | -.002 | 0 | -.005 | -.005 | -.003 | -.005 |
| | | Std. Error | | .064 | .069 | .070 | .056 | 0 | .056 | .058 | .060 | .057 |
| | | BCa 95% C. Interval | Lower | .224 | -.335 | -.229 | .289 | . | .394 | .309 | .285 | .358 |
| | | | Upper | .455 | -.040 | .025 | .503 | . | .600 | .522 | .514 | .567 |
| Depression | Pearson Correlation | | | .791** | -.245** | -.173* | .438** | .501** | 1 | .856** | .834** | .949** |
| | Sig. (2-tailed) | | | .000 | .000 | .013 | .000 | .000 | | .000 | .000 | .000 |
| | N | | | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| | Bootstrap[c] | Bias | | -.001 | -.002 | -.003 | .000 | -.005 | 0 | -.002 | -.001 | -.001 |
| | | Std. Error | | .028 | .068 | .068 | .053 | .056 | 0 | .026 | .025 | .009 |
| | | BCa 95% C. Interval | Lower | .729 | -.377 | -.302 | .321 | .394 | . | .797 | .780 | .929 |
| | | | Upper | .843 | -.114 | -.036 | .541 | .600 | | .903 | .877 | .964 |
| Anxiety | Pearson Correlation | | | .782** | -.206** | -.114 | .425** | .425** | .856** | 1 | .865** | .952** |
| | Sig. (2-tailed) | | | .000 | .003 | .102 | .000 | .000 | .000 | | .000 | .000 |
| | N | | | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| | Bootstrap[c] | Bias | | -.001 | -.003 | -.002 | -.002 | -.005 | -.002 | 0 | -.001 | .000 |
| | | Std. Error | | .032 | .068 | .066 | .055 | .058 | .026 | 0 | .020 | .008 |
| | | BCa 95% C. Interval | Lower | .714 | -.328 | -.234 | .316 | .309 | .797 | . | .818 | .933 |
| | | | Upper | .841 | -.079 | .006 | .531 | .522 | .903 | . | .904 | .967 |
| Stress | Pearson Correlation | | | .722** | -.254** | -.133 | .457** | .411** | .834** | .865** | 1 | .946** |
| | Sig. (2-tailed) | | | .000 | .000 | .057 | .000 | .000 | .000 | .000 | | .000 |
| | N | | | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| | Bootstrap[c] | Bias | | -.002 | -.003 | -.001 | -.001 | -.003 | -.001 | -.001 | 0 | .000 |
| | | Std. Error | | .037 | .072 | .071 | .054 | .060 | .025 | .020 | 0 | .008 |
| | | BCa 95% C. Interval | Lower | .649 | -.385 | -.261 | .340 | .285 | .780 | .818 | . | .928 |
| | | | Upper | .785 | -.121 | .001 | .557 | .514 | .877 | .904 | . | .960 |
| Psychological distress (Sum of D,A,S) | Pearson Correlation | | | .807** | -.249** | -.150* | .464** | .472** | .949** | .952** | .946** | 1 |
| | Sig. (2-tailed) | | | .000 | .000 | .032 | .000 | .000 | .000 | .000 | .000 | |
| | N | | | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 | 205 |
| | Bootstrap[c] | Bias | | -.001 | -.003 | -.002 | -.001 | -.005 | -.001 | .000 | .000 | 0 |
| | | Std. Error | | .026 | .069 | .069 | .050 | .057 | .009 | .008 | .008 | 0 |
| | | BCa 95% C.Interval | Lower | .748 | -.376 | -.276 | .360 | .358 | .929 | .933 | .928 | . |
| | | | Upper | .854 | -.120 | -.019 | .556 | .567 | .964 | .967 | .960 | . |

Correlation is significant at the 0.01 level (2-tailed)..
Correlation is significant at the 0.05 level (2-tailed).
Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples.

**Hypothesis 3**

It was hypothesised that relationships between FMS and social cognition, and FMS and insecure attachment will not be mediated by psychological distress. To test this hypothesis mediation analyses were conducted using PROCESS tool (Hayes, 2013) for regression.

**Figure 1. The relationship between attachment anxiety and FMS mediated by total psychological distress**.

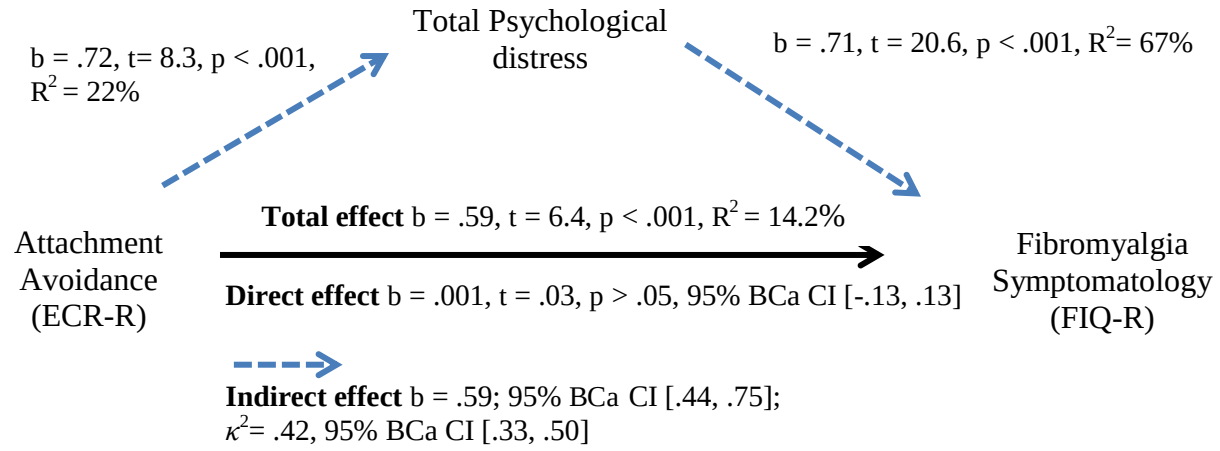



First it was tested whether there was a total or indirect effect of relationship between attachment anxiety and FMS mediated by total psychological distress, as shown in Figure 1. The model demonstrated that attachment anxiety significantly predicted total psychological distress b = .72, t = 8.30, p < .001. The $R^2$ value showed us that the attachment anxiety predicted 22% of variance in total psychological distress. The higher the attachment anxiety, the higher the person's total psychological distress and vice versa. When the psychological distress was not present in the model, attachment anxiety significantly predicted FMS, b = .39, t = 5.02, p < .001, with $R^2$ explaining 9% of the variance in FMS. The higher the attachment anxiety, the higher the FMS symptomatology. However, if the total psychological distress was introduced into the model, attachment anxiety had a negative relationship with FMS, (direct effect) b = -.12, t = 2.3, p < .05, 95% BCa CI [-.23, -.02],

meaning that the higher the attachment anxiety, the lower the FMS symptomatology. Finally the mediation analysis showed that there was a significant large ($\kappa^2$ = 46%, 95% BCa CI [.39, .54]) positive indirect effect of attachment anxiety on FMS symptoms mediated by the total psychological distress, b = .51, 95% BCa CI [.4, .63].

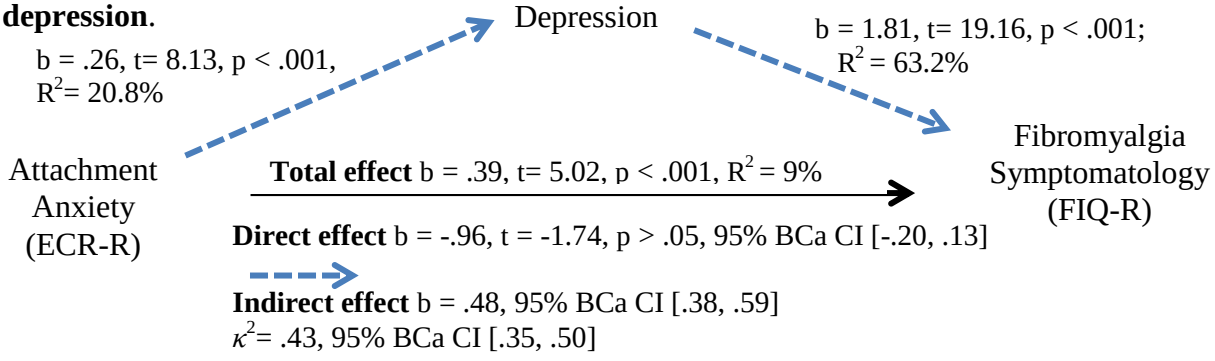
The remaining mediation effects are presented in the Figures 2 to12 below, and described with the focus on significance of the indirect effect. In other words, the descriptions focused on the presence or absence of mediation effect.

**Figure 2. The relationship between attachment avoidance and FMS mediated by psychological distress.**



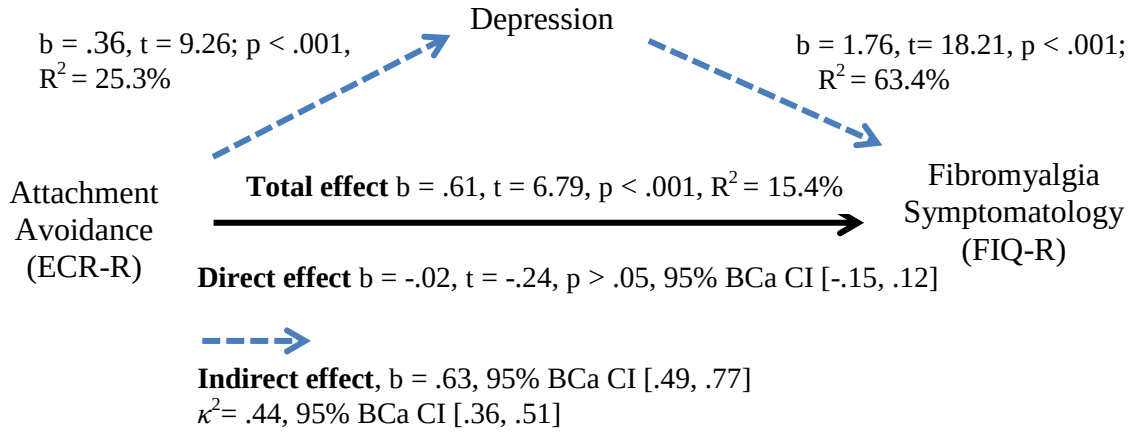

The total and the indirect effects had the same value of b = .59. However, the mediation analysis showed a large ($\kappa^2$ representing 42% of the maximum value that could have been) positive indirect effect between attachment avoidance and FMS symptoms mediated by psychological distress. The direct effect became insignificant CI [-.13, .13], where the CI crossed zero value. This suggested a strong mediation effect.

**Figure 3. The relationship between attachment anxiety and FMS mediated by depression.**



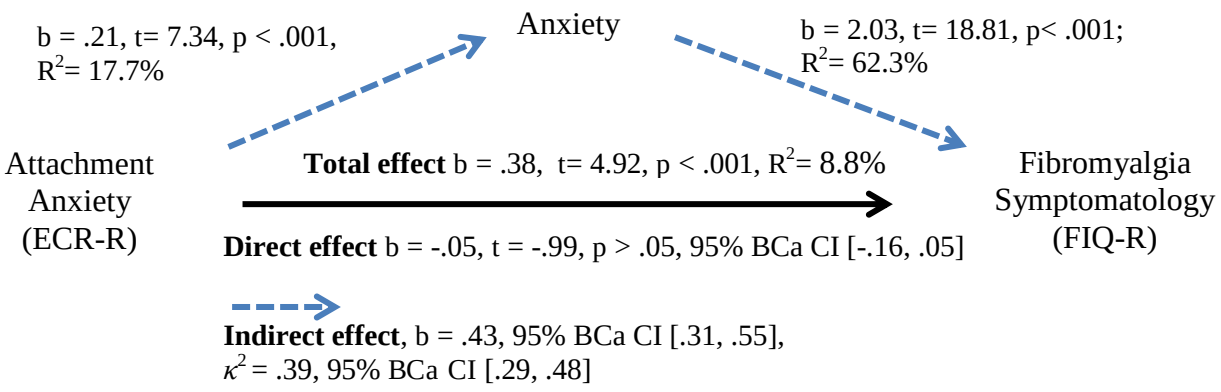
The indirect effect **(**b = .48, 95% BCa CI [.38, .59]) analysis, with $\kappa^2$ showing a large 43% of the maximum value that could have been, suggested that the relationship between attachment anxiety and FMS was mediated by depression. The insignificance of the direct effect (95% BCa CI [-.20, .13]) suggested a large mediation effect.

**Figure 4. The relationship between attachment avoidance and FMS mediated by depression**.



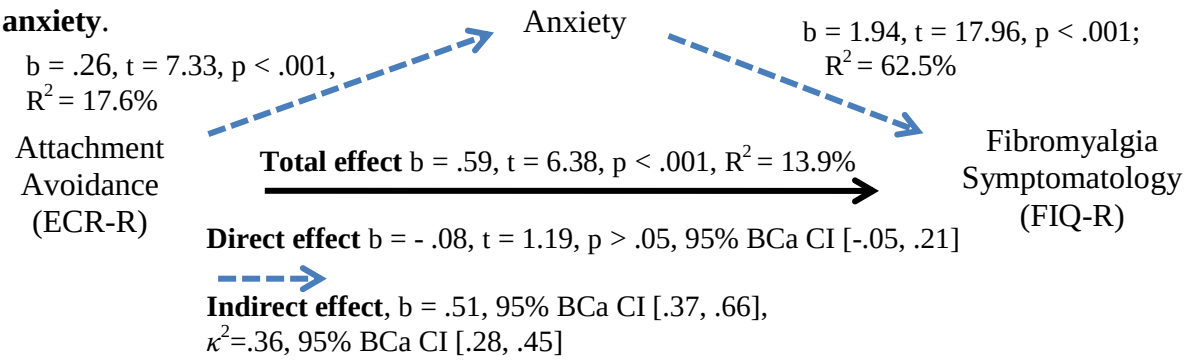

The large ($\kappa^2$ = .44) significant indirect effect b = .63, 95% BCa CI [.49, .77], and insignificant direct effect (95% BCa CI [-.15, .12]- CI crossing zero value), demonstrated that the positive relationship between attachment avoidance and FMS was strongly mediated by depression.

**Figure 5. The relationship between attachment anxiety and FMS mediated by anxiety**.



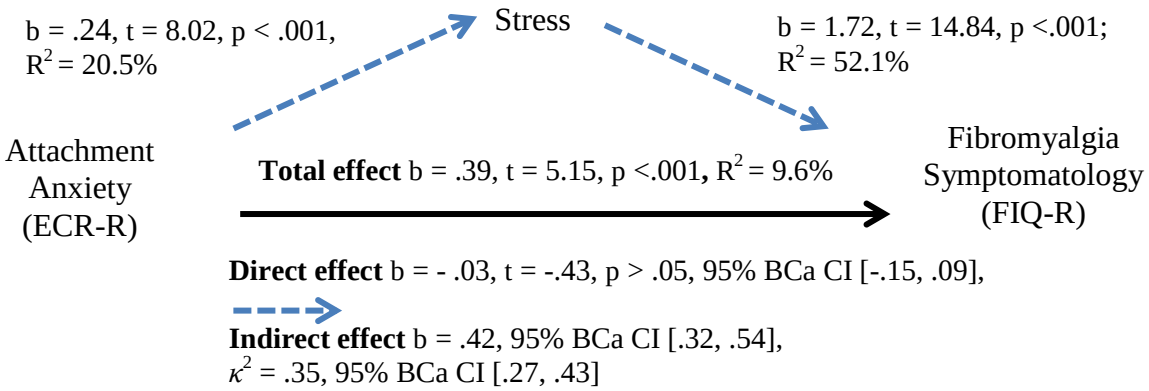
The large ($\kappa^2$ = .39) significant indirect effect, b = .43, 95% BCa CI [.31, .55], and an insignificant direct effect (95% BCa CI [-.16, .05], CI crossing zero value), suggested that a positive relationship between attachment anxiety and FMS was strongly mediated by anxiety.

**Figure 6. The relationship between attachment avoidance and FMS mediated by anxiety**.



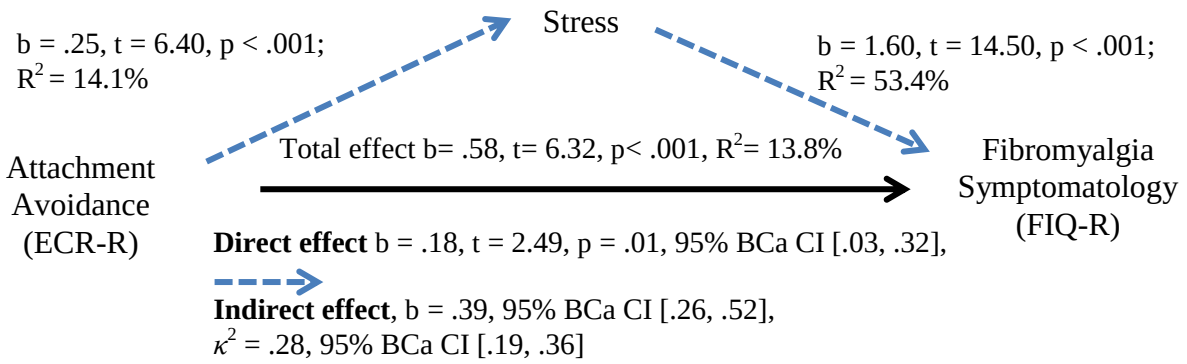

The large positive indirect effect ($\kappa^2$ = .36), b = .51, and the insignificant direct effect, CI [-.05, .21], showed that the positive relationship between attachment avoidance and FMS were strongly mediated by anxiety.

**Figure 7. The relationship between attachment anxiety and FMS mediated by stress**.



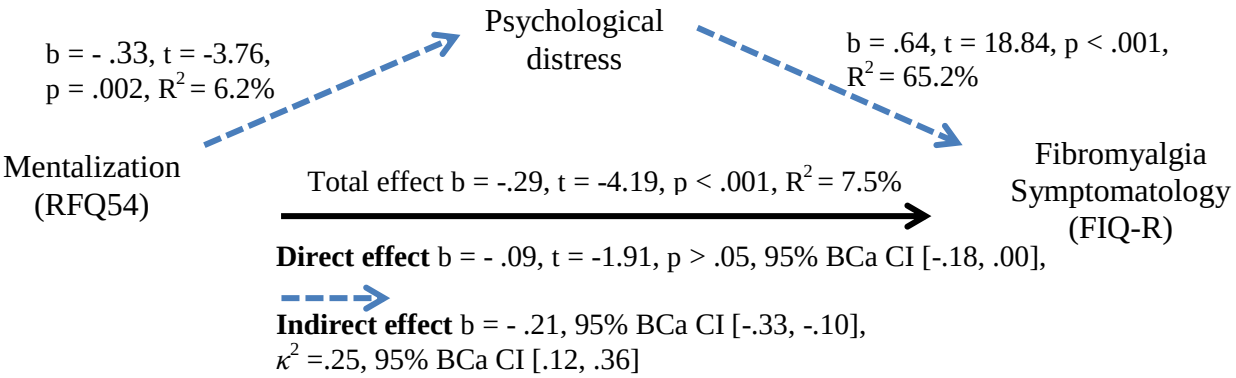

The large significant indirect effect, b = .42, $\kappa^2$ = .35, and insignificant direct effect with CI crossing zero value 95% BCa CI [-.15, .09], demonstrated that the relationship between attachment anxiety and FMS was strongly mediated by stress.

**Figure 8. The relationship between attachment avoidance and FMS mediated by stress**.



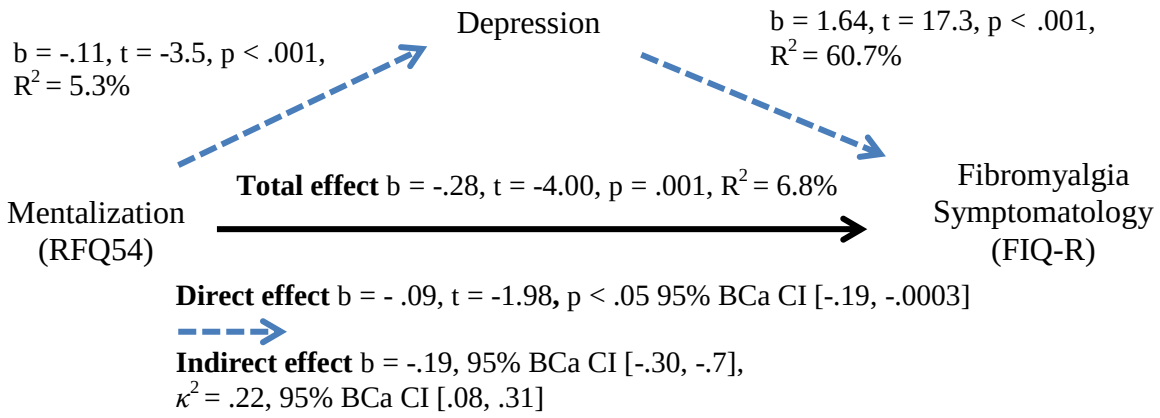

The significant indirect effect, b = .39, with $\kappa^2$ being about 28% of the maximum value that could have been, and a significant direct effect at b= .18, while total effect is b= .58, suggested that the relationship between attachment avoidance and FMS was mediated by stress.

**Figure 9. The relationship between mentalization and FMS mediated by psychological distress**.



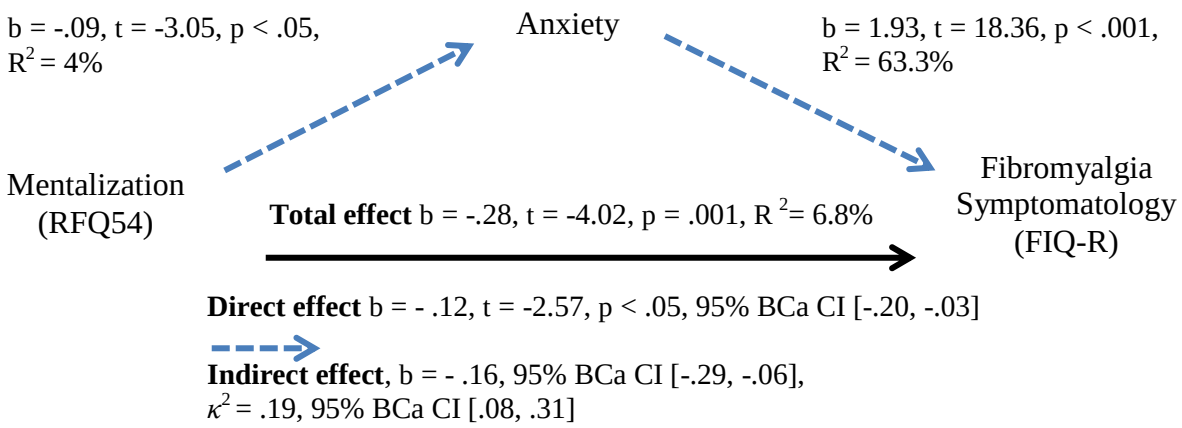

A negative large ($\kappa^2$ = .25) indirect effect, b = - .21, 95% BCa CI [-.33, -.10], and an insignificant direct effect, BCa CI [-.18, .00], showed that the negative relationship between mentalization and FMS was strongly mediated by psychological distress. In other words the higher the mentalization skills and the lower the psychological distress, the lower the FMS symptomatology.

**Figure 10. The relationship between mentalization and FMS mediated by depression**.



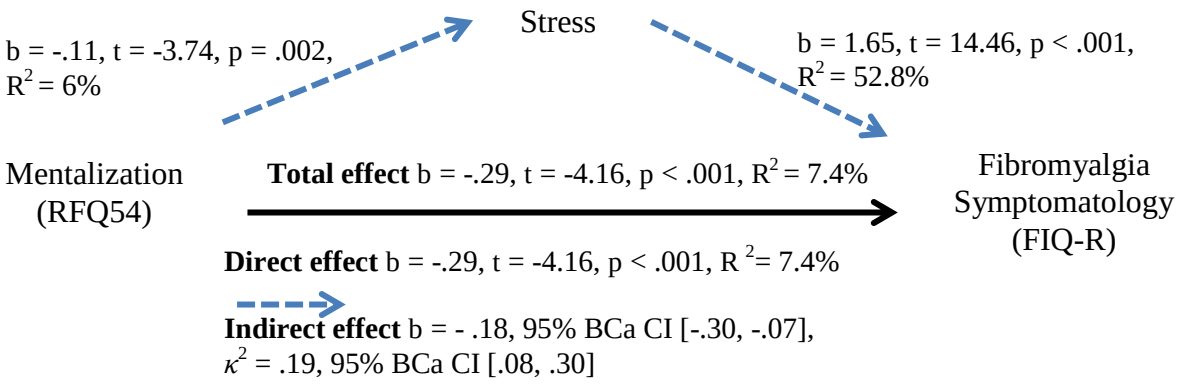

The significant negative indirect effect (b = -.19) of depression on the relationship between menalization and FMS with $\kappa^2$ = .22, suggested that the way low mentalization increased the FMS symptomatology and vice versa was mediated by depression.

**Figure 11. The relationship between mentalization and FMS mediated by anxiety**.




The medium ($\kappa^2$ = .19) negative indirect effect of anxiety on the relationship between menalization and FMS demonstrated that the way the lower the mentalization ability increased the FMS symptomatology and vice versa was mediated by anxiety.

**Figure 12. The relationship between mentalization and FMS mediated by stress.**

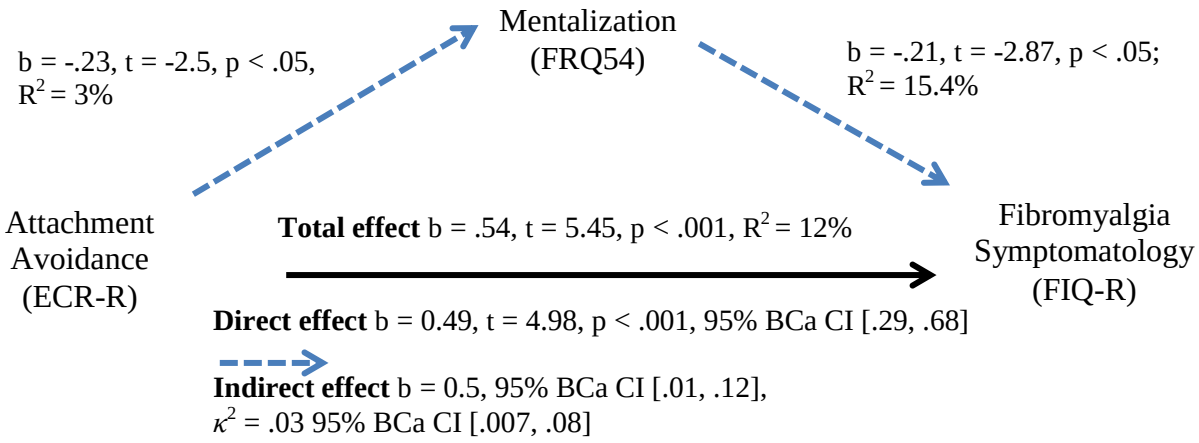



The medium ($\kappa^2$ = .19) significant negative indirect effect of stress (b = - .18, 95% BCa CI [-.30, -.07]) on the relationship between mentalization and FMS, showed that the invert relationship between the low mentalization and high FMS symptoms (and vice versa) was mediated by the stress levels.

**Hypothesis 4.**

It was hypothesised that the relationship between attachment styles and FMS symptoms would be mediated by social cognition. From previous analysis it was known that only mentalization, and not theory of mind was significantly related to FMS. Also, in order for the mediation to take place all variables need to have a statistically significant relationship. The mentalization measure related significantly only with attachment avoidance and not attachment anxiety. Therefore, only mentalization was explored as a mediator of the relationship between attachment avoidance and FMS using Hayes (2013) PROCESS bootstrap tool. There was a small size effect ($\kappa^2$ = .03), but no change in the significance between direct and indirect effects, and only a minimal change in strength of the effect. It was therefore safe to conclude that, the relationship between attachment avoidance and FMS symptomatology was not, or was very minimally mediated by mentalization (see Figure 13).

**Figure 13. The relationship between attachment and FMS mediated by mentalization**




## Discussion

This study explored relationships between FMS, insecure attachment styles and social cognition in 277 participants, out of which 105 had FMS, and 172 were healthy controls. Literature exploring these relationships is still scarce, and up to date, the published studies have been conducted outside of the UK. The current research compared the levels of insecure attachment styles, and social cognition between the two groups. Results confirmed previously reported findings (Govender et al., 2009; Kratz et al., 2012) that the population with FMS had significantly higher levels of insecure attachment styles than the general population. Previous research suggested that avoidant rather than anxious attachment was associated with FMS (Govender et al., 2009). Here, both anxiety (29% of population with FMS) and avoidant (33% of population with FMS) attachment styles were significantly more prevalent in the population with FMS than in the general population (anxiety 20%, avoidance 19%).

When assessing social cognition in the population with FMS, research to date, has focused mainly on measuring alexithymia. Although a majority of the studies suggest that this relationship is significant, it was not always confirmed (Bartely et al., 2009; Malt et al., 2002). There was a gap in the literature measuring social cognition using other scales. This

study employed a well-known measure of theory of mind (ToM)- Reading the Mind in the Eyes Test (RMET) and a new measure of mentalization- Reflective Function Questionnaire (RFQ54) which was still in the process of development and validation. Interestingly, the scores on the two measures contradicted one another. The group with FMS had lower levels of mentalization, but showed no significant difference in levels of ToM compared to HC. Perhaps the difference lies more in the ability to recognise one's own emotions (measured by some questions in RFQ54) rather than in recognising feelings of others (as measured by the RMET). However, more research is needed, employing different measures of social cognition, to clarify these findings. The RFQ54 mentalization measure focuses on recognising both one's own and other's feelings. As it was still in the process of developing and validating subscales, only a total score was used in the current analyses. It would be interesting to repeat the analysis in the future in the light of interpreting the results in terms of recognising emotions of self and others, once the subscales are established and validated.

Past studies attest to the positive correlation between FMS and insecure attachment styles (Hallber & Carlson, 1998). As there are only a few studies exploring this relationship, and so far, all of them have been conducted outside of the UK, this study wanted to test whether the results are replicable within the UK population. Indeed, there was a significant relationship between FMS and attachment anxiety ($r = .28$, $p < .001$) as well as with attachment avoidance ($r = .35$, $p < .001$).

Literature varies in reporting whether relationships between FMS and attachment or social cognition are independent of psychological distress. Studies do not always report testing for a mediation role of psychological distress. As there is no doubt that FMS is related to psychological distress, this study focused on testing out the possibility of mediation. A mediation occurs when a significant relationship between two variables becomes weaker or completely insignificant when a third variable is taken into account. This

study showed that the relationship between attachment avoidance and fibromyalgia was strongly mediated by psychological distress, especially depression and anxiety. Although stress levels significantly reduced the strength of the direct relationship between attachment avoidance and FMS ($\kappa^2 = .28$), nevertheless the direct effect remained statistically significant. The relationship between attachment anxiety and FMS was strongly mediated by all subscales of psychological distress: depression, anxiety and stress. In other words, when psychological distress was taken into account the relationship between attachment anxiety and FMS was no longer significant.

The relationship between FMS and mentalization was also strongly mediated by psychological distress as a sum of depression, anxiety, and stress. This relationship was explored with each individual subscale of psychological distress. Although there was a significant indirect effect weakening the direct relationship, the latter remained significant. This meant that individual subscales were weaker mediators than all subscales of psychological distress combined as one.

Lastly, this study set out to test whether social cognition mediates the relationship between insecure attachment and FMS. Despite the significant relationships between the variables, and literature suggesting a possibility of such a mediation model (Griffies, 2010), this effect was not observed in the current study.

To summarise, this study confirmed that there was a higher prevalence of both insecure attachment styles (anxiety and avoidance) in the population with FMS. The relationship between FMS and insecure attachment (both anxiety and avoidance) was strongly mediated by psychological distress. This could mean that if a person with FMS had an insecure attachment style, in times of distress (anxiety, depression or stress) their insecurities might become even more strongly activated. This is especially important to consider when establishing the clinician – patient relationship. Hospital appointments and

investigations are not the most relaxing of experiences. It seems that doubling the effort to ask the clinical interview questions in a relaxed and approachable manner, might go a long way in creating better chances to engage the patient with FMS in the offered care and support.

It has also been confirmed that the relationship between social cognition and FMS was mediated by psychological distress. In other words, the more distressed/depressed the patient with FMS is the more difficulties s/he will experience with identifying his/her own/other's feelings. Therefore, it might be much harder for him/her to describe how s/he is feeling in himself/herself emotionally, and s/he might be more prone to interpreting signs of emotional distress as physical symptoms of FMS. It might also be worth for clinicians to bear in mind that even if they themselves are very approachable, calm, patient, and respectable towards the patient with FMS, the patient might struggle to notice this, especially if s/he is particularly distressed. This must however, be interpreted with caution, as there was no significant relationship found between FMS and the ToM measure. In other words, the results of interpreting the emotions of other people were not consistent between different measures. The RMET measure showed no difficulty in recognising the emotions of others, whereas the RFQ54 has suggested such a difficulty. More research is needed to explore theses different aspects of social cognition difficulties in patients with FMS. Most importantly, the hypothesis of the relationship between insecure attachment and FMS being mediated by social cognition was not confirmed. It means that although social cognition is correlated with FMS, and so is insecure attachment, low levels of social cognition ability do not exacerbate the relationship between FMS and insecure attachment.

**Limitations of the study**

The results of this study should be considered in light of several limitations. This study explored correlational analyses, which does not permit to draw any conclusions on

direction of causality. It relied solely on self-report measures, which raises the possibility of findings being distorted by response bias. It also employed RFQ54 measure (RFQ54; Fonagy & Ghinai, unpublished manuscript; Moulton-Perkins & Rogoff, 2011), which has not been widely validated as yet. However, all measures have been shown to have a good internal consistency reliability (Cronbach, 1951). Perhaps it might have been better to additionally use the Toronto Alexithymia Scale (TAS), as other studies have reported using this measure. However, due to the length of the questionnaire pack, and the need to explore social cognition using other measures, TAS was not included. A few participants with FMS have commented on the length of the questionnaire pack, suggesting that it was very tiring and perhaps repetitive. The longest questionnaire, with the most missing data was RFQ54. As it is still being validated, it was decided to use the whole scale. Perhaps for future research a shorter version of this, as well as the mood questionnaire, could be employed.

It has been noted that previous research often recruited only female populations with FMS. Although this study attempted to at least meet the population with FMS ratio of one man to nine women, this has not been achieved. Therefore, it is difficult to generalise the results of this study across both genders. Also due to time constraints it was not possible to recruit participants with other chronic conditions, as a comparison group. It would however, be interesting to see whether the findings are exclusive to patients with FMS, or if they are generalizable to other chronic conditions.

**Clinical implications**

It is very important to recognise that psychological distress is strongly related to FMS and that it amplifies the relationship between FMS and insecure attachment, as well as mentalization. We know that the more insecure the attachment, the more FMS symptoms a person experiences. Social support in times of distress is one of the first remedies people naturally reach out for. When feeling additionally vulnerable, due to extreme chronic fatigue

and pain, having favourable trusting support from close relatives/friends, as well as from medical professionals, can be instrumental to manage and reduce the painful symptoms. Having an insecure attachment style makes it much harder for a person to build trusting relationships, both in personal and professional settings. This can isolate a person more than necessary, which can deepen the psychological distress and in turn increase the FMS symptoms. Struggling to trust professionals can make it very difficult for FMS sufferers to attend appointments and to seek professional support. Knowing how debilitating a condition FMS is, a more holistic approach to managing the symptoms gives a better prognosis of outcomes. Therefore, regular contact with relevant professionals is important for continuity of care. While it is difficult to treat someone's insecure attachment, we can expect that if the psychological distress is reduced, the influence of insecure attachment on FMS symptoms would also weaken. We can presume a similar effect of psychological distress on the relationship between the inability to recognise one's own/other's feelings and FMS symptoms. It might be beneficial to assess someone's mood, attachment style, and social cognition ability, around the time of diagnosis of FMS, which is when the relationships with professionals begin to build. Knowing whether someone might have difficulties attending appointments due to fear of rejection and criticism, or because of severe pain, might inform professionals of a more appropriate treatment approach.

**Research implications**

As the two social cognition measures did not relate to FMS in the same way, and studies so far mainly use Toronto Alexithymia scale, it would be interesting to see whether using different measures of social cognition, e.g. Levels of Emotional Awareness Scale (LEAS; Lane, Quinlan, Schwartz, Walker, & Zeitlin), or Movie for the Assessment of Social Cognition (MASC; Dziobek et al., 2006) would clarify those relationships further.

There is still a significant lack of studies including male participants with FMS. It would be worthwhile to explore whether there are differences in the way attachment styles or social cognition affect the symptoms in men and women.

Testing what the best psychological treatment approaches are, to reduce the psychological distress levels in the population with FMS could also be beneficial. Is there a difference between patients who come into contact with psychology through a 'one stop shop' diagnostic clinic, or through a referral from the rheumatologist or GP? Are group therapy/ distress management programmes better than an individual therapy for this population? Although this is a very debilitating condition which greatly effects people's stamina, it has been repeatedly observed in this study that the population with FMS is quite keen to take part in research, as there is still a lot to learn about this illness.

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**Karolina Oracz**

MAJOR RESEARCH PROJECT

# SECTION C

# CRITICAL APPRAISAL

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**What research skills and abilities have you developed from carrying out this project and what do you think you need to learn further?**

This project was a new experience for me as the lead researcher. At every step of this journey I have learnt something new and have expanded my research skills. I was lucky to have quite quickly found a supervisor who was willing to supervise a student in the area of functional somatic disorders, and who had a great experience in working with this group of patients. She was open to explore several avenues of research before agreeing to support me on one particular path. This allowed me to familiarise myself with gaps in research a bit better, before deciding on a particular area. I have learnt that having a supervisor, or a research colleague to consult with, is crucial for support through the inevitable moments of doubt and struggle through various stages of research. I have learnt that research has moments of intensive, sometimes stressful preparation for proposing the research, and then waiting for approval from different ethics committees. However, it also has many moments of exciting discovery, and learning about areas of study which have already been explored or are waiting to be tested.

Initially, I knew very little about Fibromyalgia Syndrome and the daily struggles people with fibromyalgia face. I have learnt that constructing some draft hypothesis is important at the beginning of research as an anchor from which to start exploring literature in more detail. Conversations with field experts, as well as with other researchers, who might have more or different experiences of conducting projects in a particular or similar area, proved essential to place that initial anchor.

Stepping through the process of applying for NHS ethics, as well as local Research and Development approvals has been an invaluable experience. Initially nerve wracking, but now, with much more understanding, I can approach it with more confidence and ease. The

more one talks about the project to other people, the easier it is to follow it through, and to consider significant, not only technical but, ethical issues.

Having recruited using both paper form questionnaires as well as on-line questionnaires, I have learnt the benefits and drawbacks of both. Although it is much easier to access higher numbers of participants on line, and it might be easier to ensure less missing data, there is a very limited contact with the participant. Even though I was not able to use the qualitative information which I have come across while inviting participants to take part in the research over the phone, I have been greatly inspired by participants with FMS to complete the study. I know that not everyone comes across participants who are enthusiastic, but having the opportunity to introduce the study personally, gives the researcher a chance to find out whether people are interested in following the results at all, and if it would benefit them.

I have also learned that the hypothesis for the research can change many times. However, having a robust knowledge of past research findings is essential to maximise robust outcomes of the study, by asking participants and the collected data the right questions.

It has also been a considerable time since I last explored statistical analysis or opened SPSS. Refreshing my knowledge on correlation and regression analysis has been most useful. Also learning new models of statistical analysis such Baron and Kenny's (1986) model of mediation and moderation, or the PROCESS model of indirect effect with bootstrapping (Hayes, 2013) and mediation analysis, has been very interesting and helpful. I would certainly like to learn more about running different statistical analysis.

Finally, I have understood the rigours of a major research project. Despite the guidance and support from supervisors and colleagues, nothing can quite prepare you for the uncertainty of research, where for example one path of enquiry can be rendered obsolete by a recently published paper. I found it a trying, frustrating, inspiring and fulfilling process in

equal measure. The struggles starting with gathering and consolidating the data, initiating the proposal, through to trawling through the literature research and finally formulating and evaluating the hypothesis, results and considering the clinical and future research impact was an invaluable experience.

**If you were to do this project again, what would you do differently and why?**

I would certainly be less scared of asking the wrong questions. The more knowledge prior to data collection, the easier it is to plan an appropriate time scale for the project, select appropriate questionnaires, consider ethical dilemmas etc.

I would also expect more stumbles along the way, and therefore plan twice as much contingency as initially drawn out. Planning research is not only dependent on participant availability, time constraints, other responsibilities taking over from time to time, or personal unexpected health issues, but also knowing that some R&Ds, or REC committees take longer time than others to respond to questions and applications.

As I mentioned earlier, I would certainly try to find a fellow researcher or research supervisor to help me stay motivated and on track with the project. Therefore, if I could take time back, I would have tried to set dates at the beginning, of when to check in with my supervisor regarding the progress. I would celebrate successes of small steps more, and more openly discuss the stumbles, earlier on. This would help me to stay more focused and evenly motivated, while allowing more opportunities for the different ideas to flow, as each conversation about the project brought some new light on the matter.

Perhaps I would have piloted the study with a small group of participants with FMS, e.g. a local fibromyalgia support group. This could help to find out whether the questionnaire pack was too burdensome for the participants, or not, and whether it should be shortened. It could also suggest which questions caused most distress or difficulties. Perhaps I would use a shorter version of DASS next time and if subscales of RFQ54 (Fonagy & Ghinai,

unpublished manuscript; Moulton-Perkins & Rogoff, 2011) were developed, I would have used only those, rather than all 54 questions. Having shorter scales of both questionnaires, might have given me enough space to add the Toronto Alexithymia Scale (TAS; Taylor et al. 1988), and subsequently see whether the results of majority of the researchers (e.g. Pedrosa Gill et al., 2008) would be confirmed on a British population. Also if there was more time available, it would be interesting to see whether using a Movie for Assessment of Social Cognition Measure (MASC; Dziobek et al., 2006) gives similar results.

The male fibromyalgia participants are still massively under-researched, and studies often exclude male participants. Although I have attempted to recruit both men and women to this study, I only managed to collect data from a few male participants. If I was given another chance perhaps I would pay more attention to targeting this understudied population.

**Clinically, as a result of doing this study, would you do anything differently?**

Based on literature findings, I initially hypothesised that the relationship between insecure attachment styles and fibromyalgia symptomology would be mediated by social cognition. Prior to this study, I would have contemplated focusing my therapeutic approach on improving mentalization abilities in those fibromyalgia sufferers in whom this difficulty was identified. This study has not confirmed the above hypothesis. However, I strongly believe that this area of research needs to be further explored with a use of different social cognition measures, as literature around the significance of these relationships is not consistent.

The current study strongly suggests that psychological distress is greatly impacting on the increase of fibromyalgia symptomatology. Knowing that psychological distress is a contributing factor to at least two factors increasing fibromyalgia symptoms (social cognition and insecure attachment), I would try to carefully plan together with the multidisciplinary team, what would be the best way to assess psychological distress. It would also be important to consider at which point of the fibromyalgia assessment or treatment should the

psychological distress assessment take place. Would it be worth attempting the psychological assessment at the same time as the medical assessment, or would that be too much of a burden for a person with FMS to take? If the latter was the case, then when would be a good point to invite someone for assessment?

Even though the relationship between insecure attachment and FMS was not mediated by social cognition, the mentalization measure was shown to be significantly related to FMS. This is similar to previous studies suggesting that alexithymia is significantly more prevalent in the population with FMS than in the general population. If this is true, then the possible difficulty with identifying one's own feelings and the ability to name the distress, may impact on the mood assessment. This needs to be considered when choosing or interpreting a self-report mood measure.

Nevertheless, it is important to stress, that not all people with FMS suffer from mood disorders, poor mentalization, or insecure attachment. Therefore, in clinical practice it would be worth considering whether it is better to routinely screen patients with FMS for the presence of any of these three difficulties or to wait for a referral from a rheumatologist, or GP.

**If you were to undertake further research in this area what would that research project seek to answer and how would you go about doing it?**

To my knowledge this was the first quantitative study to test whether the relationships between fibromyalgia and insecure attachments are mediated by poor social cognition. Therefore, it would be important to repeat this study, but perhaps considering different measures of social cognition. As the Toronto Alexithymia Scale was often used in the past it would be worth checking whether the results in the UK population with FMS would replicate those from abroad. If time was not a constraint for the research, as it was in the case of the current study, I would suggest a different assessment of social cognition. One of the options

would be to use the Levels of Emotional Awareness Scale (LEAS; Lane, Quinlan, Schwartz, Walker, & Zeitlin) where a person could be interviewed face to face. The researcher could then ensure that the missing data is minimal. This measure although containing qualitative data, which can cause more difficulty with result interpretation, is perhaps more thorough in assessing levels of social cognition. Also the Movie for the Assessment of Social Cognition (MASC; Dziobek et al., 2006) could be used. Here a participant would need to watch a film with actors expressing different emotions and then answer some questions regarding their understanding of the scenes. It requires different engagement of social cognitive abilities from the participant than the questionnaire measures such as RMET or RFQ54.

I would also hope to spend more time recruiting more male participants, and perhaps testing out whether the levels of insecure attachment styles, social cognition, or psychological distress differ between male and female groups. This could inform a different approach to treatment or help to generalise data from different studies.

If I was to further explore the area of fibromyalgia, I would first of all speak to the experts in this field, talk about my study findings and try to learn from others what, if anything, would they be interested in exploring further. As the sample size in the current study was large and participants gave a lot of information about their experiences, it could be possible to further explore the same database for different hypothesis. Knowing what hypothesis one wants to test, further data collection might not even be necessary.

I would also consider contacting other researchers exploring fibromyalgia/functional somatic disorders, social cognition or attachment, and see whether data from their studies could be combined with this study to test other hypothesis and make other group comparisons.

There are many possibilities of expanding the research, but the first questions should always be: what would be beneficial to explore from the perspective of a person with FMS?

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## SECTION D

## APPENDIX OF SUPPORTING MATERIAL

# Appendix 1

## Literature Search Strategy

The systematic literature review sought to explore whether there are relationships between fibromyalgia, social cognition, and attachment. A search was performed in April 2013 and updated in January 2014 on the following electronic databases: PsycINFO, the Current Index to Nursing and Allied Health Literature (CINAHL), Medline, Cochrane Database of Systematic Reviews, Web of Knowledge: Web of Science, and ASSIA. A web based search using the 'Google Scholar' engine was also performed.

The following terms were searched for using Boolean operators 'OR', 'AND', as well as related terms option: (Fibromyalgia OR functional somatic disorder) AND (theory of mind OR mentalization OR alexithymia OR social cognition); (Fibromyalgia OR functional somatic disorder) AND attachment; (Fibromyalgia OR functional somatic disorder) AND (theory of mind OR mentalization OR alexithymia OR social cognition) AND attachment.

After removal of duplicates 131 articles remained. Titles were scanned for relevance and abstracts/articles were read when inclusion was initially unclear. The references of papers were also manually reviewed for relevance. Only empirical studies which discussed the relationship between fibromyalgia and attachment or social cognition were included.

## Inclusion and exclusion criteria

The search was limited to peer-reviewed journals published in English language.

Although experience of trauma is often related to attachment, papers which only discussed trauma but not attachment itself in connection with fibromyalgia were excluded from this review due to word constraints of this paper. If papers discussed functional somatic disorders without specific focus on fibromyalgia population, there were also excluded.

A total of 12 studies were found discussing the relationship between fibromyalgia and social cognition, and 6 studies discussing the fibromyalgia and attachment. These papers form the basis of this review.

## Appendix 2

### Overview of empirical studies on FMS and social cognition included in the review

| Studies on Fibromyalgia and Social Cognition | | | |
|---|---|---|---|
| **Reference/ country** | **Sample** | **Measures** | **Key findings** |
| **1.**<br>Bartley, E. J., Rhudy, J. L., & Williams, A. E. (2009)<br><br>USA, Oklahoma | 17 FMS (1 man)<br>(mean age 48.59)<br>17 HC (1 man)<br>(mean age 43)<br><br>Years of education:<br>FMS mean 15.2<br>HC mean 16.18<br><br>Employment:<br>FMS 7% full time<br>5% part time<br>HC 11% full time<br>3% part time<br><br>Marital status:<br>FMS 11% married<br>HC 7% married<br><br>Any significant differences? | 1. International Affective Picture System (IAPS) - picture stimuli, presented on a computer screen, using Lab VIEW software which controlled all data acquisition, picture stimuli and questionnaire administration.<br>2. Depression Scale (CES-D)<br>3. FIQ<br>4. TAS-26<br>5. Self Assessment Manikin (SAM) - (affective reaction)<br>6. Corrugator EMG- frowning muscles activity measure<br>7. Heart Rate measure<br>8. Acoustic Startle Reflex measure<br>9. Skin Conductance Response (SCR) | Participants with FMS:<br>- had higher tender-point count,<br>- were more likely to use antidepressant medication,<br>- had more pain-related problems (FIQ scores).<br><br>There were no significant differences found on the alexithymia traits between FMS and HC. |
| **2.**<br>Castelli, L., Tesio, V., Colonna, F., Molinaro, S., Leombruni, P., Bruzzone, M., Fusaro, E., Sarzi-Puttini, P., & Torta, R.<br>(2012) .<br><br>Italy | Women only<br><br>FMS 55 (mean age 52.8)<br><br>Education:<br>primary school 14.5%<br>secondary school 45.5%<br>university 7.3 %<br><br>Employment:<br>employed 54.5%<br>unemployed 5.5%<br>retired 20%<br>house wife/not working 20%<br><br>Marital status<br>single 9.1%<br>living together 36%<br>married 72.7%<br>divorced 9.2%<br>widowed 55.5% | 1. FIQ<br>2. TAS 20<br>3. Hospital Anxiety and Depression Scale (HADS)<br>4. Distress Thermometer (DT)<br>5. VAS for current pain.<br>6. Health Related Quality of Life (36 Health Survey SF-36) | Results showed that alexithymia was present in 20% of the patients; the percentage increased to 47% when patients with alexithymic trait at a subclinical level were included. These percentages were found to be significantly higher with respect to the ones of the general population, estimated between 6 and 8% (Steinweg et al., 2011).<br><br>FM patients are affected by a high level of psychological distress.<br>Pain duration showed to be positively correlated with depression but not with the HRQoL.<br>Alexithymia does directly influence the QoL of FMS patients. The relationship between FMS and alexithymia is partially mediated by the presence of psychological distress. |

| Reference/ country | Sample | Measures | Key findings |
|---|---|---|---|
| **3.**<br>Greenen, R., van Ooijen-van der Linden, L., Lumley, M. A., Bijlsma, J. W. J., & van Middendorp, H.<br><br>(2012)<br><br>The Netherlands | Women only<br><br>55 FMS (mean age 52.8)<br><br>Education:<br>Primary school 14.5%<br>secondary school 77%<br><br>Employment:<br>employed 54.5%<br>unemployed 5.5%<br>retired 20%<br>house wife/not working 20%<br><br>Marital status:<br>living together 36 %<br>married 72.7% | 1. Berkley Expressivity Questionnaire (BEQ)<br>2. TAS-20<br>3. Emotional Approach Coping Scales (EACS)<br>4. Emotion Regulation Questionnaire (ERQ)<br>5. FIQ | Both affect intensity and alexithymia were associated with a more severe impact of FMS. Emotion expression was associated with less severe impact of FMS. Cognitive reappraisal was not associated with FMS impact.<br><br>In alexithymic patients, cognitive reappraisal was not a more suitable emotion regulation strategy than emotion expression. Emotion expression was not associated with worse functioning in people with alexithymia. |
| **4.**<br>Huber, A., Suman, A. L., Biasi, G., & Carli, G.<br><br>(2009)<br><br>Italy | Women only<br><br>68 FMS both in and out patients (mean age 43.4).<br><br>Education:<br>35.2% secondary school<br><br>Employment:<br>70% employed<br><br>Marital status:<br>57.8% married | 1. 150 min duration epidemiological-amnestic interview<br>2. Psychophysical test<br>3. Physiological tests (von Fey monofilaments, deep-pressure algometry, cold pressor test, and cold pain and heat pain test).<br>4. Pain intensity visual analogue scale<br>5. QUID- Italian questionnaire of pain psychological distress<br>6. CESD<br>7. State Trait Anxiety Inventory<br>8. TAS-20<br>9. Illness behaviour questionnaire | 19% of the patients were labelled as "alexithymic" on the TAS-20 measure, which is a significant percentage compared to healthy Italian women as described by Bressi et al., 1996. The significantly higher total alexithymia scores, were due to the alexithymia DIF facet only.<br>Higher scores on alexithymia DIF were significantly correlated with:<br>- lower cold pressor pain tolerance,<br>- higher ongoing affective pain,<br>- higher psychological distress, and<br>- higher scores on illness behaviour subscales (hypochondriasis and disease conviction).<br>Hypochondriasis was significantly and positively correlated with alexithymia "Difficulty Describing Feelings" (DDF), Education was negatively correlated with DDF and alexithymia "externally oriented thinking" (EOT).<br>Alexithymia DIF ceased to be a unique predictor of ongoing affective pain when considered together with either psychological distress ("general distress" and state anxiety) or illness behaviour (hypochondriasis and disease conviction). In contrast, "general distress", state anxiety, and hypochondriasis all made mutually independent contributions to predicting ongoing affective pain when considered together with alexithymia DIF.<br>Alexithymia DIF uniquely predicted hypochondriasis beyond what was explained by psychological distress and ongoing affective pain taken together. Alexithymia DIF remained a significant predictor of disease conviction when age and psychological distress were controlled for, but not when age and affective pain were controlled for. |

| Reference/ country | Sample | Measures | Key findings |
|---|---|---|---|
| **5.**<br>Malt, E. A., Olafsson, S., Lund, A., & Ursin, H.<br><br>(2002)<br><br>Norway | All participants were Caucasian women.<br>FMS: 42 with fibromyalgia (mean age 45)<br>HC: 48 (mean age 43)<br><br>A subgroup of 22 patients with FMS and 13 controls underwent pharmacological challenge test.<br><br>Education:<br>mean 11 years / no difference between groups | 1. Eyesenck Personality Questionnaire-Neuroticism (EPQ-N) scale<br>2. EPQ-L-lie scale<br>3. Toronto Alexithymia Scale (TAS)-26 item (difficulty identifying feelings DIF, difficulty describing feelings DDF, externally oriented thinking EOT).<br>4. Multi-Dimensional Health Locus of Control Scale (MHLCS): internal, external, or chance<br>5. Buspirone Challenge Test to assess autonomic and adrenocortical responsiveness. | No differences on alexithymia scores between FMS and the HC.<br>A high correlation was found between the scores for alexithymia, anxiety, depression and neuroticism. |
| **6.**<br>Pedrosa Gil, F., Weigl, M., Wessels, T., Irnich, D., Baumüller, E., & Winkelmann, A.<br><br>(2008)<br><br>Germany | Women only<br>40 FMS<br>(mean age 55.7)<br><br>Education:<br>27.5% secondary school or more<br><br>Employment:<br>62.5% were employed, | 1. TAS-26 item- German version<br>2. Measure of Parental Style (in German): indifference, overprotection, abuse.<br>3. Symptom Checklist-90 Revised (SCL-90-R)<br>4. Global Severity Index<br>5. BDI | In this study population with FMS reached an average of 51 TAS total score.<br>15% of patients scored over the cut-off T-value of 61 for alexithymia, which shows a clinically significant alexithymia in this population. The prevalence of alexithymia in the general population is suggested to be 9.4% for men and 5.2% for women (Kokkonen et al., 2001) |
| **7.**<br>Peñacoba Puente, C., Velasco Furlong, L., Gallardo, C. É., & Cigarán Méndez, M.<br><br>(2013)<br><br>Spain | Women only<br><br>120 FMS (mean age 50.9)<br>120 HC (mean age 49.2)<br><br>Education:<br>FMS 22% secondary school<br>HC 19.5% secondary school<br>FMS 13.8% University<br>HC 15% University<br><br>Employement:<br>FMS 29.2% working<br>HC 42.6% working<br><br>Marital Status:<br>FMS 81% married<br>HC 75.8% married | 1. HADS<br>2. TAS 20 | FMS showed increased levels compared to HC on alexithymia anxiety and depression. FMS scored higher in all age ranges on alexithymia. Alexithymia increased with age across both groups.<br>In the general population after the age of 65, anxiety scores return to those found among women under the age of 35. In FMS group, however; there is a progressive increase of anxiety over age.<br>For all age ranges, FMS group obtained significantly higher scores on depression than HC.<br>HC had low levels of depression, which increase as age increases, resulting in a slight decrease from 65 onwards. |

| Reference/ country | Sample | Measures | Key findings |
|---|---|---|---|
| **8.**<br>Sayar, K., Gulec, H. & Topbas, M.<br><br>(2004)<br><br>Turkey | Women only<br>50 FMS (mean age 40.5)<br>20 RA (mean age 45.6)<br>42 HC (mean age 38.8)<br><br>Education:<br>FMS – 20% second. school<br>RA- 10% Second. School<br>HC – 14.2 % Sec. School<br><br>Marital status:<br>FMS 90% married<br>RA 80% married<br>HC 88.1% married | 1. The Beck Anxiety Inventory (BAI)<br>2. The Beck Depression Inventory (BDI)<br>3. State-Trait Anger Expression Inventory (STAXI)<br>4. TAS- 20 items<br>5. Fibromyalgia Impact Questionnaire (FIQ)<br>6. Disability/Severity of pain was recorded with the Visual Analog Scale (VAS) of 100 mm length by patients. | FMS scored higher on the measure of alexithymia and anger-in than did the RA or HC, even when the pain severity and depression were controlled for.<br>Pain severity was determined by the levels of anxiety and anger-out in the FMS. |
| **9.**<br>Steinweg, D. L., Dallas, A. P., & Rea, W. S.<br><br>(2011)<br><br>VA, USA | FMS 50 (mean age 54.1)<br>RA 50 (mean age 59.8)<br>General Medicine (GM) 50 (mean age 65.3)<br><br>Male participants:<br>FMS 8.3%<br>RA 30.2%<br>GM 63.9%<br><br>Education above secondary school:<br>FMS 63.8%<br>RA 41.9<br>GM 71.4% | 1. Demographic info<br>2. TAS-20<br>3. BDI | Patients with FMS had a high prevalence of alexithymia, present in almost half. Moderate to severe depression was the strongest predictor of presence of alexithymia in FMS. When the depression was controlled for, the differences in alexithymia scores became insignificant. Thus, the higher rate of alexithymia seen in FMS patients may be due only to the high prevalence of depression.<br>Patients with FMS may have problems expressing their feelings, particularly compared with patients with other medical conditions, and the comorbid state of depression is likely responsible. Although FMS patients were taking more of each category of antidepressant medication and depressive symptoms remained more prevalent in this group. |
| **10.**<br>Tuzer, V., Dogan Bulut, S., Bastug, B., Kayalar, G., Göka, E., & Beştepe, E.<br><br>(2011)<br><br>Tureky | Only women<br><br>70 FMS (mean age 38.97)<br>56 Chronic Low Back Pain (CLBP) (mean age 44.23)<br>72 HC (mean age 36.97)<br><br>Mean years of Education:<br>FMS 6.46<br>CLBP 5.12<br>HC 7.89<br><br>Marital status:<br>FMS 88.6% married<br>CLBP 84.6% married<br>HC 78% married | 1. Brief Symptom Inventory (BSI)<br>2. TAS-20<br>3. Symptom Interpretation Questionnaire (SIQ) | Alexithymia, somatization, depression, anxiety and hostility scores were significantly higher in FMS than in CLBP and HC groups. However, when the effects of psychological distress were controlled for, the relationship became insignificant. Psychological attributions increased parallel to alexithymia levels in FMS patients.<br>As alexithymia DIF and DDF reciprocally predicted depression and anxiety, it is not clear whether alexithymia is a secondary defensive reaction against negative affect or a personality trait related to emotional trauma.<br>Interestingly, despite heightened psychological distress, FMS patients were not seeking psychiatric support. |

| Reference/ country | Sample | Measures | Key findings |
|---|---|---|---|
| **11.**<br>Van Middendorp, H., Lumley, M. A., Jacobs, J. W. G., Doornen, L. J. P., Bijlsma, J. W. J., & Greenen, R.<br><br>(2008)<br><br>The Netherlands | Women only<br>403 FMS (mean age 46.5)<br>196 HC (mean age 45.6)<br><br>Education:<br>FMS 77% second. School<br>HC 72% second. school<br><br>Employment:<br>FMS 12% full time<br>33% part time<br>HC 23% full time<br>49% part time<br><br>Marital status:<br>FMS 69% married<br>HC 79% married | 1. Positive And Negative Affect Schedule (PANAS-X)<br>2. Emotional Approach Coping Scales (EACS)<br>3. Emotional Regulation Questionnaire (ERQ)<br>4. Dutch State Trait Anger Expression Inventory (STAEI)<br>5. Self-Expression and Control Scale (SECS)<br>6. TAS-20<br>7. Berkley Expressivity Questionnaire (BEQ)<br>8. FIQ<br>9. Multidimensional Pain Inventory (MPI) | In the FMS group negative feelings and the use of emotional-avoidance strategies were elevated, while positive emotions were reduced;<br>The alexithymia scale "Difficulty Identifying Feelings (DIF)" showed a large deviation from norm in FMS;<br>Emotional-approach measures were normal;<br>Emotional-avoidance strategies were highly correlated with more mental distress and were modestly correlated with more pain and fatigue, while emotional-approach strategies were only minimally related to better functioning;<br>The intense experiencing of emotions was related to more pain only in patients who lack the ability to process or describe emotions.<br>Although FMS patients showed deficits in the experiencing of positive affect, positive affect did not buffer the association between pain and negative affect. |
| **12.**<br>Weiβ, S., Winkelmann, A., & Duschek, S.<br><br>(2013)<br><br>Germany | Women only<br><br>35 FMS (mean age 58.5)<br>35 HC (mean age 57.3)<br><br>Education:<br>FMS 31.4% higher education<br>HC 45.7% higher education | 1. Structured Clinical Interview for Axis I Disorder of DSM (ASKID)<br>2. MPQ- McGill Pain Questionnaire<br>3. BDI<br>4. State Trait Anxiety Inventory (STAI)<br>5. TAS-20<br>6. Karolinska Directed Emotional Faces Battery (KDEF)<br>7. Self-assessment Manikin Scale (SAM). | Participants with FMS scored significantly higher on all the alexithymia parameters compared to the HC. Also, participants with FMS had markedly lower performance on an emotional face recognition task.<br>FMS group misclassified more images showing happy, angry, disgusted, anxious, sad, and neutral expressions, but no group differences arose regarding the ratings on the arousal and valence dimensions of emotional experience.<br>The distribution of specific misclassifications did not differ between the groups indicating generally reduced recognition accuracy rather than a systematic pattern of mistakes.<br>Higher questionnaire scores of clinical pain severity, depression, state and trait anxiety and the three dimensions representing alexithymia were associated with lower task performance.<br>The TAS parameters were inversely related to face recognition performance.<br>The patients' difficulty in classifying emotional faces may at least partly be regarded as a consequence of their general deficit in identifying and describing feelings. The significant correlations of the BDI and STAI scores with task performance suggested that increased levels of depression and anxiety may also contribute to the patients' difficulty in identifying emotional expressions. |

# Appendix 3

## Overview of empirical studies on FMS and attachment included in the review

| Studies on fibromyalgia and attachment | | | |
|---|---|---|---|
| **Reference/ country** | **Sample** | **Measures** | **Key findings** |
| **1.** Govender, C., Cassimjee, N., Schoeman, J., & Meyer, H. (2009) South Africa | 29 FMS (25 women and 4 men) All participants were white (mean age 42.52) Relationship status: 79.32% in a relationship | 1. Attribution Style Questionnaire (ASQ) 2. Experiences in Close Relationships-Revised Questionnaire (ECR-R) 3. Orientation to Life Questionnaire (OLQ) 4. BDI-II | FMS mean attachment anxiety score was lower than that of general online population. FMS Mean attachment avoidance score was higher than that of general online population. The population with FMS has more avoidant but less anxious attachment style than the general population.<br><br>51.72% of participants were securely attached 41.38% were insecurely attached, these included: 13.79% with a preoccupied attachment style (high attachment anxiety and low attachment avoidance) 6.90% with a dismissing-avoidant attachment style (high attachment avoidance and low attachment anxiety) 20.69% with a fearful avoidant attachment style (high attachment avoidance and high attachment anxiety).<br><br>Insecurely attached group displayed significantly higher levels of depression, hopelessness and negative attribution characteristic relative to those with secure attachment. They were more likely to exhibit negative attribution characteristics and higher levels of depression and hopelessness than their secure counterparts. They tended to exhibit a low sense of coherence, have a negative attribution style and more severe depression. |
| **2.** Griffies, W. S. (2010). Louisiana, USA | 1 man with FMS (age 33) Higher education, chief admin officer. Married with no children. Mr. W. presented with significant deficits in stress and affect regulation, and a deficit in capacity for mentalization that appeared to be derived from an insecure attachment. His body was an object that hurt, an obstacle to his pursuit for perfection, it had no real self-representational meaning to him. His attention was on making himself perfect for others, not on discovering his authentic body/mind self. | Long term psychoanalysis case study. | Experiencing stress and trauma in early life conditions development of those neurobiological stress regulatory systems in our brains, which are responsible for how we will respond to stress later in life. The stress regulatory systems work automatically and maintain homeostasis. They do not exhibit symbolically, therefore cannot be addressed directly with psychoanalytic interpretations.<br><br>Mr. W. felt his body was distressful and bad because it could not, on a sensorimotor level, conform to his mother's rigid needs, and so secure an attachment. Body arousal of nearly any level or quality came to be perceived as painful and threatening, and was encoded that way by his subsymbolic, subcortical stress and pain processing networks. This kind of chronic aversive stimulation is thought to be one way that central sensitization develops, whereby, eventually, the nervous system generates its own pain centrally, without peripheral input (Staud, 2002; Staud et al., 2004).<br><br>The capacity to mentalize body and affect requires a secure attachment;<br>When body affect is so dangerous that it must be inhibited by subcortical neural networks before it can be symbolized, development of the mental self is blocked. In such situation those who are insecurely attached might not know their own thoughts, feelings, beliefs, and ideas, and feel quite lost, and take on false self-representations (Winnicott, 1960). This false-self structure is sometimes integrated so thoroughly that the patient denies psychic distress altogether, except in the context of the painful somatic disorder. Psychotherapy must then create a safe and validating holding environment, a secure attachment, with relationship interactions that foster the capacity to mentalize body affects. Psychotherapeutic experiences that focus on internalizations of self-object and relational interactions may enable structural change even in neurobiological systems operating at a subcortical and non-symbolic level. |

| Reference/ country | Sample | Measures | Key findings |
|---|---|---|---|
| **3.**<br>Hallberg, L. R.-M., & Carlsson, S. G.<br><br>(1998)<br><br>Sweden | 22 women (aged 22-60)<br><br>25% of FMS were ≤ 30 | Qualitative study-grounded theory.<br><br>Interviews around the experiences and beliefs of the pain and its origin and how it affects family and social life. | Early attachment experiences which are linked to the development of FMS come under the core concept of 'Psychosocial vulnerability' and a subcategory of 'traumatic life history'.<br>Traumatic life history is composed of:<br>experiences of early loss (losing a parent due to death, divorce or adoption/relocation due to war, or losing a child- all these contributing to high levels of separation anxiety and feelings of rootlessness);<br>responsibility early in life (being fostered for labour purposes, caring for younger siblings, housekeeping, starting work while still being at school);<br>social problems (in the primary family: alcohol abuse, violence, psychiatric illness);<br>helplessness, and powerlessness (feelings of having no control over what is happening to them, and no power to defend themselves).<br>Majority of participants had complicated/chaotic life histories including repeated traumatic events. The insecure attachment styles were overrepresented in this group. Authors hypothesised that these women's attachment behaviours were frustrated in infancy, leading to insecure attachment styles. This in turn often manifested in their interactional patter which was characterised by ambivalence between help-seeking and withdrawal, so called 'doctor shopping' (Mikail, Henderson, & Tasca, 1994). |
| **4.**<br>Kratz, A. L., Davis, M. C., & Zautra, A. J.<br><br>(2012)<br><br>Arizona, USA | 210 women with FMS and/or OA (mean age 57.22)<br>91% Caucasian<br><br>Education:<br>39% graduated college<br><br>Employment:<br>58% employed at least part time<br><br>Relationship status:<br>58.9% had a partner | 1. Relationship Questionnaire (RQ)<br>Additional coding procedure following Cohen et al. (2003) was conducted to compare participants on high and low attachment avoidance and anxiety.<br>2. Daily pain diary using numerical scale between 0 and 100 on:<br>- intensity<br>- catastrophizing (pain never ending, or not being able to stand any more pain)<br>- coping (employing strategies such as expressing emotions and seeking emotional support) | This study explored who is likely to catastrophize when pain is high, and the extent to which differences in attachment avoidance predict who is likely to cope socially when catastrophizing is high.<br>48.6% securely attached<br>26.2% dismissing attachment style<br>18.1% fearful attachment style<br>7.1% preoccupied attachment style<br>74.8% low attachment anxiety (-0.5)<br>25.2% high attachment anxiety (+0.5)<br>55.7% low attachment avoidance (-0.5)<br>44.3% high attachment avoidance (+0.5)<br>No significant differences in attachment style or relationship status between FMS and OA. No differences in mean levels of pain intensity, catastrophizing and social coping between low and high attachment anxiety.<br>Those with high attachment avoidance sustained higher mean pain and pain catastrophizing, compared to those with low avoidance. Avoidant individuals also endorsed significantly lower mean social coping.<br>Days of increased pain predicted increased catastrophizing, and the pain-related increases were significantly greater for anxious than non-anxious individuals. Those high in attachment anxiety demonstrated a significantly greater increase in catastrophizing in the context of increased pain compared to those low in anxiety.<br>Daily increases in pain and catastrophizing were related to increases in social coping. With increased use of non-social coping strategies, use of social coping decreased. Avoidance but not anxiety was a significant moderator of the relation between changes in pain catastrophizing and social coping. High avoidance was related to smaller increase in social coping in the context of increased catastrophizing.<br>Anxious women with poor self-concept reported greater increase in catastrophizing on days of increased pain. Avoidant women demonstrated greater reticence to cope socially in the context of increased pain catastrophizing.<br>Attachment relates not only to reactions to pain, but also to the experience (frequency and intensity) of pain. |

| Reference/ country | Sample | Measures | Key findings |
|---|---|---|---|
| **5.**<br>Oliveira, P., & Costa, M. E.<br><br>(2009)<br><br>Portugal | 128 women FMS (mean age 47.41)<br><br>Education: 31.3% primary school<br><br>Employment: 53.1% employed<br><br>Marital status: 85.2% married | 1. Socio-demographic Questionnaire<br>2. Romantic Attachment Questionnaire: with four subscales relating to their romantic partner: trust, dependence, avoidance, ambivalence<br>3. Short Form Health Survey 36 Item<br>4. Worrying Scale of Pain Coping Inventory | Explored associations between attachment, health status and worrying and whether worrying mediated the relationship between attachment and health outcomes in the population with FMS<br><br>Physical health status is inversely correlated with dependence and worrying.<br>Mental health status was positively correlated with trust and inversely with dependence and ambivalence.<br>Worrying mediated the relation between dependence and physical and mental health status, as well as partially mediated the relationship between ambivalence and mental health status. |
| **6.**<br>Pedrosa Gil, F., Weigl, M., Wessels, T., Irnich, D., Baumüller, E., & Winkelmann, A.<br><br>(2008)<br><br>Germany | Women only<br>40 FMS (mean age 55.7)<br><br>Education: 27.5% secondary school or more<br><br>Employment: 62.5% were employed, | 1. TAS-26 item-German version<br>2. Measure of Parental Style (in German): indifference, overprotection, and abuse- from both parents during their first 16 years of life.<br>3. Symptom Checklist-90 Revised (SCL-90-R)<br>4. Global Severity Index<br>BDI | Difficulty identifying feelings was significantly correlated with parental style, symptom severity and depression.<br>Mother's abusive and indifferent parental styles were correlated with total alexithymia scores even when the symptom severity was controlled for.<br>When depression and symptom severity were controlled for father's indifferent parental style remained significantly positively correlated with difficulty identifying feelings.<br><br>Father's indifferent attachment style is associated with difficulty identifying feelings.<br>In FMS patients, both father and mother figures are associated with alexithymic features.<br><br>Moreover, women with FMS are more likely to report a history of sexual and/or physical abuse than women without FMS. This study demonstrated also that a majority of patients with FMS show psychiatric symptoms, especially affective disorders. |

## Appendix 4

**Approval letters from Research Ethics Committee**

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## Appendix 5

**Permission from Research and Development Departments Site A**

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**Permission from Research and Development Departments Site B**

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## Appendix 6

### Invitation letter to take part in the study

Logo of the research site

Department of [redacted]

*Clinic:* [redacted]
*Nurse Helpline:*
*Fax:*
*Main Switchboard:*

Date:

Dear

I am writing to you today because you had contact with the fibromyalgia team at [redacted].

I would like to invite you to take part in an innovative research study that aims to explore how people with fibromyalgia understand what others are thinking and feeling, as well as how people think about their own thoughts and feelings. The study is questionnaire based, where you would be asked to select answers on a scale from 0 to 10. It takes between 30 to 45 minutes to complete.

More information about this study is available in the participant information sheet attached to this letter. This study is being undertaken by [redacted], a trainee clinical psychologist at Christ Church University Canterbury. The questionnaires can be filled in at home or at [redacted].

A follow-up phone call from the lead researcher will take place soon after you receive this letter. This phone call will allow you to ask questions about the research and to opt in or out of the study. If you would prefer not to be contacted, please contact the researcher directly via e-mail: [redacted]

Many thanks in advance for your time.

Yours sincerely,

Dr [redacted]

Consultant Rheumatologist

## Appendix 7

### Participant information sheet


Participant Information Sheet
(Version 3, 18.03.2013)

Logo of the research site

**Relationships, Emotions and Fibromyalgia**

Dear Participant,

You are being invited to take part in a research study that is being completed as part of an educational project for a Doctorate in Clinical Psychology. Your decision to take part in the study is entirely voluntary and will not have any impact upon your care. You are being invited to take part solely because your views are important to this research. Before you decide whether or not to take part in this study it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. After you have read through the information take some time to decide whether or not you still wish to take part.

**What is the purpose of the research study?**
We are trying to gain a better understanding of the causes of Fibromyalgia. Fibromyalgia is a physical health condition that causes pain throughout the body. We know that the symptoms are very real, not exaggerated and often very disabling for people who suffer from this illness. We also know that these symptoms become worse when there is physical or emotional stress present in the patient's life. This study aims to look at how people experience such stresses. We would like to know whether and how people understand what others are thinking and feeling, as well as how people think about their own thoughts and feelings. Greater knowledge in this area will help in designing better psychological therapies for people who have a diagnosis of fibromyalgia.

**Why have I been chosen to take part in this study?**
We are recruiting people who have received a diagnosis of fibromyalgia as well as people without such physical health problems to see how things like experiences of relationships, understanding different feelings or interpreting other's facial expressions differ among people. This knowledge may help us understand better how certain experiences influence fibromyalgia symptoms.

**Who is organising the study?**
My name is [redacted] and I am a trainee clinical psychologist. I will be supervised by Dr. [redacted] from [redacted] Trust, and Professor Paul Camic from Canterbury Christ Church University.

**Who has reviewed the study?**
This study has been reviewed and approved by an Independent Canterbury Christ Church University Research Panel, as well as by the [redacted] Research Ethics Committee. This is to protect your safety, well-being, rights and dignity.

**What will happen to me if I take part?**
You will be asked to answer series of questions marking the answer on a scale between 0 and 10, and look at some pictures of faces and tell us what you think they are expressing (choosing from 4 given options). This questionnaire will take about 30 to 45 minutes of your time.

**What are the possible risks and benefits of taking part?**
It is possible that it may be upsetting to be asked some questions relating to relationships, feelings or experiences. If it becomes too difficult to carry on at any point, you can decide to end the questionnaire.

The knowledge gained from the study may help improve the treatment of Fibromyalgia in the future.

In case something went wrong while the study is taking place I am insured with the Travelers Insurance Company for the duration of this research project.

**Confidentiality**
All documents related to the study will be kept in a locked filing cabinet and/or on an encrypted pen drive/ CD and only the researchers will have access to them. No-one outside the study will know the names of the participants. The questionnaires will not be linked directly to people's names. People's names and consent forms will be kept separately from the questionnaire data. Data will be stored with a number and not with people's names attached.

**What will happen to the results of this study?**
It is intended to use the results of this study for my doctoral thesis, which is required by Canterbury Christ Church University. Also I plan to publish this study for scientific purposes. Your identity will not be revealed in any publications.

**Can I withdraw from this study?**
You are free to decline to take part or to withdraw from this study at any time without giving a reason. If you are a patient your medical care will not be in any way affected by such decision.

**A prize draw**
If you are interested and would like to participate in this study, you can chose to enter a prize draw for the possibility of winning a £40 amazon voucher.

**Who can I contact if I am upset by this study?**
If you have a diagnosis of fibromyalgia you can contact a Fibromyalgia Support Group at: http://www.ukfibromyalgia.com/fm-support-groups/fm-support-groups.html;

If you are based in [redacted] area you can contact the fibromyalgia support group using a helpline: [redacted], or e-mail: [redacted]

If you are based in [redacted] area you can contact [redacted] Fibro Support Group at: www.[redacted]; via e-mail: [redacted]; or helpline: [redacted]

If you are based in [redacted], you can contact the Fibro Support Group XXXXX Helpline: [redacted], or e-mail: [redacted]

If the study has touched on some issues that you would like to talk more about (whether you have fibromyalgia or not) you can contact your GP for a counselling referral. Alternatively, you can contact a confidential help line: Samaritans 08457 90 90 90.

General information about participating in research can be obtained from INVOLVE (promoting public involvement in NHS, public health and social care research) www.invo.org.uk, 02380 651 088. Alternatively, you can contact your local Patient Advisory Liaison Service (the number is available through NHS Direct 0845 46 47). Formal complaints about the research should be addressed to Prof. Paul Camic at Canterbury Christ Church University
tel: (44) 01892 507 773

You can take part in the study by filling in a paper-form questionnaire or using an on-line survey. If would like to take part in the study please contact Ms [redacted] using the contact details below.

Alternatively, if you are coming to hospital for your (pain or fibromyalgia) clinic appointment you can receive the paper-form questionnaire from your clinician/ admin staff member and fill it in whilst waiting for or after your appointment. You can do so in the designated waiting area. Once the questionnaire is completed you can leave it with your clinician/ admin staff member who handed you the questionnaire. Prior to filling in the questionnaire you will be asked to sign a consent form.

If you have any further questions please contact me on the address below.

[redacted],
Trainee Clinical Psychologist

Department of Applied Psychology,
Canterbury Christ Church University,
Salomons Campus
Broomhill Road,
Tunbridge Wells,
Kent TN3 0T

Alternatively you can contact me via e-mail on: [redacted]

## Appendix 8

**Consent form**

Appendix 8

Canterbury Christ Church University

**CONSENT FORM**
**(Version 3, 18.03.2013)**

Logo of the research site

**'Relationships, Emotions and Fibromyalgia' Research Study**

Name of Researcher: [redacted]

Please tick box

☐ I confirm that I have read and understand the information sheet version 3 dated 18.03.2013 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

☐ I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my medical care or legal rights being affected.

☐ I agree to take part in the above study.

☐ I wish to be entered into the prize draw. I give my name and postal address so a £40 amazon voucher may be sent to me if in the event that my name is drawn.

e-mail address (only if you want to take part in the amazon voucher draw, or want to receive information regarding the study):

_____

Alternatively you can provide your postal address

| | |
|---|---|
| Name | |
| House number | |
| Street | |
| Town | |
| Postcode | |

_____ _____ _____

Name Date Signature

For office use only
Version 3, 18.03.2013
Participant number:

## Appendix 9

**The questionnaire pack for the healthy controls**

This has been removed from the electronic copy

**The fibromyalgia questionnaire pack differed from the healthy control pack only on two pages (pages four and five) which are included below, the rest of the questionnaire was identical therefore it was not copied again.**

## Appendix 10

**Table A. Group Statistics for measures of FMS, social cognition and attachment**

| clinical or nonclinical | | | Statistic | Bootstrap[a] | | | |
|---|---|---|---|---|---|---|---|
| | | | | Bias | Std. Error | BCa 95% Confidence Interval | |
| | | | | | | Lower | Upper |
| Fibromyalgia Symptoms | Fibromyalgia | N | 70 | | | | |
| | | Mean | 69.26 | -.08 | 2.45 | 64.05 | 73.96 |
| | | Std. Deviation | 19.519 | -.220 | 1.586 | 16.666 | 21.882 |
| | | Std. Error Mean | 2.333 | | | | |
| | control | N | 135 | | | | |
| | | Mean | 15.07 | -.03 | 1.15 | 13.01 | 17.19 |
| | | Std. Deviation | 13.301 | -.206 | 1.509 | 10.564 | 15.676 |
| | | Std. Error Mean | 1.145 | | | | |
| Mentalization | Fibromyalgia | N | 70 | | | | |
| | | Mean | 230.27 | -.02 | 3.49 | 222.82 | 237.09 |
| | | Std. Deviation | 29.688 | -.345 | 3.075 | 23.998 | 34.673 |
| | | Std. Error Mean | 3.548 | | | | |
| | control | N | 135 | | | | |
| | | Mean | 243.66 | .08 | 2.10 | 239.31 | 247.97 |
| | | Std. Deviation | 24.334 | -.181 | 1.867 | 21.034 | 27.699 |
| | | Std. Error Mean | 2.094 | | | | |
| Theory of mind | Fibromyalgia | N | 70 | | | | |
| | | Mean | 26.66 | -.01 | .40 | 25.86 | 27.37 |
| | | Std. Deviation | 3.443 | -.021 | .305 | 2.909 | 3.982 |
| | | Std. Error Mean | .411 | | | | |
| | control | N | 135 | | | | |
| | | Mean | 26.97 | .00 | .34 | 26.30 | 27.68 |
| | | Std. Deviation | 4.052 | -.028 | .261 | 3.566 | 4.475 |
| | | Std. Error Mean | .349 | | | | |
| Attachment Anxiety | Fibromyalgia | N | 70 | | | | |
| | | Mean | 67.36 | .09 | 2.98 | 60.78 | 73.08 |
| | | Std. Deviation | 24.833 | -.274 | 1.700 | 21.609 | 27.251 |
| | | Std. Error Mean | 2.968 | | | | |
| | control | N | 135 | | | | |
| | | Mean | 58.57 | .12 | 1.91 | 54.63 | 62.78 |
| | | Std. Deviation | 23.302 | -.088 | .934 | 21.529 | 24.757 |
| | | Std. Error Mean | 2.006 | | | | |
| Attachment Avoidance | Fibromyalgia | N | 70 | | | | |
| | | Mean | 67.84 | -.05 | 2.29 | 63.39 | 72.34 |
| | | Std. Deviation | 18.407 | -.237 | 1.558 | 15.681 | 20.782 |
| | | Std. Error Mean | 2.200 | | | | |
| | control | N | 135 | | | | |
| | | Mean | 58.27 | .12 | 1.63 | 55.04 | 61.84 |
| | | Std. Deviation | 19.251 | -.094 | .973 | 17.563 | 20.988 |
| | | Std. Error Mean | 1.657 | | | | |

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

**Table B. Group Statistics for psychological distress**

| clinical or nonclinical | | | Statistic | Bootstrap[a] | | | |
|---|---|---|---|---|---|---|---|
| | | | | Bias | Std. Error | BCa 95% Confidence Interval | |
| | | | | | | Lower | Upper |
| Depression | Fibromyalgia | N | 70 | | | | |
| | | Mean | 27.20 | -.02 | 1.79 | 23.57 | 30.71 |
| | | Std. Deviation | 14.369 | -.180 | 1.024 | 12.505 | 15.859 |
| | | Std. Error Mean | 1.717 | | | | |
| | control | N | 135 | | | | |
| | | Mean | 6.77 | .01 | .68 | 5.40 | 8.14 |
| | | Std. Deviation | 7.951 | -.058 | .578 | 6.820 | 8.944 |
| | | Std. Error Mean | .684 | | | | |
| Anxiety | Fibromyalgia | N | 70 | | | | |
| | | Mean | 22.41 | -.01 | 1.47 | 19.53 | 25.18 |
| | | Std. Deviation | 12.328 | -.137 | .824 | 10.832 | 13.546 |
| | | Std. Error Mean | 1.474 | | | | |
| | control | N | 135 | | | | |
| | | Mean | 5.74 | -.01 | .61 | 4.60 | 6.91 |
| | | Std. Deviation | 7.249 | -.049 | .637 | 6.101 | 8.341 |
| | | Std. Error Mean | .624 | | | | |
| Stress | Fibromyalgia | N | 70 | | | | |
| | | Mean | 27.56 | -.01 | 1.38 | 24.77 | 30.17 |
| | | Std. Deviation | 11.730 | -.115 | .850 | 10.093 | 13.158 |
| | | Std. Error Mean | 1.402 | | | | |
| | control | N | 135 | | | | |
| | | Mean | 10.89 | .01 | .85 | 9.21 | 12.59 |
| | | Std. Deviation | 9.615 | -.035 | .542 | 8.604 | 10.529 |
| | | Std. Error Mean | .828 | | | | |
| Psychological Distress | Fibromyalgia | N | 70 | | | | |
| | | Mean | 77.17 | -.04 | 4.35 | 68.57 | 85.29 |
| | | Std. Deviation | 35.958 | -.402 | 2.535 | 31.160 | 39.738 |
| | | Std. Error Mean | 4.298 | | | | |
| | control | N | 135 | | | | |
| | | Mean | 23.40 | .01 | 1.91 | 19.58 | 27.20 |
| | | Std. Deviation | 22.085 | -.133 | 1.449 | 19.325 | 24.578 |
| | | Std. Error Mean | 1.901 | | | | |

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

## Frequencies Analysis

**Table C. Theory of mind total cut off**

| clinical or nonclinical | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Fibromyalgia | Valid | impaired | 22 | 21.0 | 23.4 | 23.4 |
| | | normal | 72 | 68.6 | 76.6 | 100.0 |
| | | Total | 94 | 89.5 | 100.0 | |
| | Missing | System | 11 | 10.5 | | |
| | Total | | 105 | 100.0 | | |
| control | Valid | impaired | 28 | 16.3 | 16.4 | 16.4 |
| | | normal | 143 | 83.1 | 83.6 | 100.0 |
| | | Total | 171 | 99.4 | 100.0 | |
| | Missing | System | 1 | .6 | | |
| | Total | | 172 | 100.0 | | |

**Table D. RFQ54 Total recoded into 3 scores**

| clinical or nonclinical | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Fibromyalgia | Valid | low | 31 | 29.5 | 36.9 | 36.9 |
| | | medium | 39 | 37.1 | 46.4 | 83.3 |
| | | high | 14 | 13.3 | 16.7 | 100.0 |
| | | Total | 84 | 80.0 | 100.0 | |
| | Missing | System | 21 | 20.0 | | |
| | Total | | 105 | 100.0 | | |
| control | Valid | low | 26 | 15.1 | 18.2 | 18.2 |
| | | medium | 74 | 43.0 | 51.7 | 69.9 |
| | | high | 43 | 25.0 | 30.1 | 100.0 |
| | | Total | 143 | 83.1 | 100.0 | |
| | Missing | System | 29 | 16.9 | | |
| | Total | | 172 | 100.0 | | |

**Table E. Recoded total attachment avoidance ranges**

| clinical or nonclinical | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Fibromyalgia | Valid | low | 16 | 15.2 | 17.2 | 17.2 |
| | | medium | 42 | 40.0 | 45.2 | 62.4 |
| | | high | 35 | 33.3 | 37.6 | 100.0 |
| | | Total | 93 | 88.6 | 100.0 | |
| | Missing | System | 12 | 11.4 | | |
| | Total | | 105 | 100.0 | | |
| control | Valid | low | 51 | 29.7 | 30.0 | 30.0 |
| | | medium | 86 | 50.0 | 50.6 | 80.6 |
| | | high | 33 | 19.2 | 19.4 | 100.0 |
| | | Total | 170 | 98.8 | 100.0 | |
| | Missing | System | 2 | 1.2 | | |
| | Total | | 172 | 100.0 | | |

**Table F. Recoded total attachment anxiety ranges**

| clinical or nonclinical | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Fibromyalgia | Valid | low | 16 | 15.2 | 18.0 | 18.0 |
| | | medium | 43 | 41.0 | 48.3 | 66.3 |
| | | high | 30 | 28.6 | 33.7 | 100.0 |
| | | Total | 89 | 84.8 | 100.0 | |
| | Missing | System | 16 | 15.2 | | |
| | Total | | 105 | 100.0 | | |
| control | Valid | low | 50 | 29.1 | 29.4 | 29.4 |
| | | medium | 84 | 48.8 | 49.4 | 78.8 |
| | | high | 36 | 20.9 | 21.2 | 100.0 |
| | | Total | 170 | 98.8 | 100.0 | |
| | Missing | System | 2 | 1.2 | | |
| | Total | | 172 | 100.0 | | |

**Table G. DASS total recoded into 5 categories**

| clinical or nonclinical | | | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|---|---|
| Fibromyalgia | Valid | normal | 53 | 50.5 | 76.8 | 76.8 |
| | | mild | 6 | 5.7 | 8.7 | 85.5 |
| | | moderate | 7 | 6.7 | 10.1 | 95.7 |
| | | severe | 2 | 1.9 | 2.9 | 98.6 |
| | | extremely severe | 1 | 1.0 | 1.4 | 100.0 |
| | | Total | 69 | 65.7 | 100.0 | |
| | Missing | System | 36 | 34.3 | | |
| | Total | | 105 | 100.0 | | |
| control | Valid | normal | 167 | 97.1 | 98.2 | 98.2 |
| | | mild | 2 | 1.2 | 1.2 | 99.4 |
| | | moderate | 1 | .6 | .6 | 100.0 |
| | | Total | 170 | 98.8 | 100.0 | |
| | Missing | System | 2 | 1.2 | | |
| | Total | | 172 | 100.0 | | |

**Table H. Descriptive Statistics for the whole sample**

| | | Statistic | Bootstrap[a] | | | |
|---|---|---|---|---|---|---|
| | | | Bias | Std. Error | BCa 95% Confidence Interval | |
| | | | | | Lower | Upper |
| Fibromyalgia Symptoms | Mean | 33.57 | -.06 | 2.07 | 29.56 | 37.31 |
| | Std. Deviation | 30.144 | -.136 | 1.091 | 27.926 | 31.828 |
| | N | 205 | 0 | 0 | . | . |
| Mentalization | Mean | 239.09 | .05 | 1.86 | 235.44 | 242.88 |
| | Std. Deviation | 26.974 | -.106 | 1.717 | 23.803 | 29.930 |
| | N | 205 | 0 | 0 | . | . |
| Theory of mind | Mean | 26.86 | .00 | .26 | 26.36 | 27.40 |
| | Std. Deviation | 3.849 | -.012 | .200 | 3.466 | 4.229 |
| | N | 205 | 0 | 0 | . | . |
| Attachment Anxiety | Mean | 61.57 | .11 | 1.63 | 58.35 | 65.14 |
| | Std. Deviation | 24.139 | -.081 | .864 | 22.599 | 25.595 |
| | N | 205 | 0 | 0 | . | . |
| Attachment Avoidance | Mean | 61.54 | .07 | 1.33 | 59.00 | 64.32 |
| | Std. Deviation | 19.460 | -.089 | .845 | 17.836 | 20.860 |
| | N | 205 | 0 | 0 | . | . |
| Depression | Mean | 13.75 | .00 | 1.02 | 11.84 | 15.70 |
| | Std. Deviation | 14.342 | -.082 | .812 | 12.782 | 15.659 |
| | N | 205 | 0 | 0 | . | . |
| Anxiety | Mean | 11.43 | -.01 | .86 | 9.77 | 13.15 |
| | Std. Deviation | 12.196 | -.053 | .674 | 10.824 | 13.357 |
| | N | 205 | 0 | 0 | . | . |
| Stress | Mean | 16.58 | .00 | .90 | 14.86 | 18.38 |
| | Std. Deviation | 13.040 | -.040 | .535 | 12.089 | 13.938 |
| | N | 205 | 0 | 0 | . | . |
| Psychological Distress (Sum of D, A, S) | Mean | 41.76 | -.01 | 2.64 | 36.60 | 46.88 |
| | Std. Deviation | 37.564 | -.174 | 1.976 | 33.910 | 40.711 |
| | N | 205 | 0 | 0 | . | . |

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

**Table I. Independent Samples Test**

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | T | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | | Lower | Upper |
| Fibromyalgia Symptoms | Equal variances assumed | 17.484 | .000 | 23.445 | 203 | .000 | 54.192 | 2.311 | 49.634 | 58.749 |
| | Equal variances not assumed | | | 20.853 | 103.147 | .000 | 54.192 | 2.599 | 49.038 | 59.346 |
| Mentalization | Equal variances assumed | 3.780 | .053 | -3.459 | 203 | .001 | -13.388 | 3.870 | -21.019 | -5.757 |
| | Equal variances not assumed | | | -3.249 | 118.069 | .002 | -13.388 | 4.120 | -21.547 | -5.228 |
| Theory of mind | Equal variances assumed | .838 | .361 | -.552 | 203 | .582 | -.313 | .568 | -1.433 | .806 |
| | Equal variances not assumed | | | -.581 | 160.958 | .562 | -.313 | .539 | -1.378 | .752 |
| Attachment Anxiety | Equal variances assumed | .000 | .999 | 2.503 | 203 | .013 | 8.787 | 3.510 | 1.865 | 15.708 |
| | Equal variances not assumed | | | 2.453 | 132.200 | .015 | 8.787 | 3.582 | 1.701 | 15.872 |
| Attachment Avoidance | Equal variances assumed | .692 | .407 | 3.425 | 203 | .001 | 9.569 | 2.794 | 4.060 | 15.077 |
| | Equal variances not assumed | | | 3.474 | 145.384 | .001 | 9.569 | 2.754 | 4.126 | 15.012 |
| Depression | Equal variances assumed | 42.104 | .000 | 13.111 | 203 | .000 | 20.430 | 1.558 | 17.357 | 23.502 |
| | Equal variances not assumed | | | 11.050 | 91.462 | .000 | 20.430 | 1.849 | 16.757 | 24.102 |
| Anxiety | Equal variances assumed | 32.876 | .000 | 12.183 | 203 | .000 | 16.674 | 1.369 | 13.975 | 19.372 |
| | Equal variances not assumed | | | 10.420 | 94.397 | .000 | 16.674 | 1.600 | 13.497 | 19.851 |
| Stress | Equal variances assumed | 3.933 | .049 | 10.900 | 203 | .000 | 16.668 | 1.529 | 13.653 | 19.683 |
| | Equal variances not assumed | | | 10.239 | 118.081 | .000 | 16.668 | 1.628 | 13.444 | 19.892 |
| Psychological Distress (Sum of D, A, S) | Equal variances assumed | 24.575 | .000 | 13.230 | 203 | .000 | 53.771 | 4.064 | 45.758 | 61.785 |
| | Equal variances not assumed | | | 11.442 | 96.727 | .000 | 53.771 | 4.699 | 44.444 | 63.099 |

**Table J. Bootstrap for Independent Samples Test**

| | | Mean Difference | Bootstrap[a] | | | | |
|---|---|---|---|---|---|---|---|
| | | | Bias | Std. Error | Sig. (2-tailed) | BCa 95% Confidence Interval | |
| | | | | | | Lower | Upper |
| Fibromyalgia Symptoms | Equal variances assumed | 54.192 | -.049 | 2.703 | .001** | 48.656 | 59.269 |
| | Equal variances not assumed | 54.192 | -.049 | 2.703 | .001** | 48.656 | 59.269 |
| Mentalization | Equal variances assumed | -13.388 | -.093 | 4.116 | .002** | -21.572 | -5.504 |
| | Equal variances not assumed | -13.388 | -.093 | 4.116 | .004** | -21.572 | -5.504 |
| Theory of mind | Equal variances assumed | -.313 | -.014 | .531 | .580 | -1.322 | .641 |
| | Equal variances not assumed | -.313 | -.014 | .531 | .576 | -1.322 | .641 |
| Attachment Anxiety | Equal variances assumed | 8.787 | -.031 | 3.554 | .017* | 1.385 | 15.691 |
| | Equal variances not assumed | 8.787 | -.031 | 3.554 | .018* | 1.385 | 15.691 |
| Attachment Avoidance | Equal variances assumed | 9.569 | -.166 | 2.858 | .001** | 4.039 | 14.755 |
| | Equal variances not assumed | 9.569 | -.166 | 2.858 | .001** | 4.039 | 14.755 |
| Depression | Equal variances assumed | 20.430 | -.030 | 1.873 | .001** | 16.723 | 24.197 |
| | Equal variances not assumed | 20.430 | -.030 | 1.873 | .001** | 16.723 | 24.197 |
| Anxiety | Equal variances assumed | 16.674 | -.003 | 1.567 | .001** | 13.472 | 19.673 |
| | Equal variances not assumed | 16.674 | -.003 | 1.567 | .001** | 13.472 | 19.673 |
| Stress | Equal variances assumed | 16.668 | -.017 | 1.598 | .001** | 13.443 | 19.578 |
| | Equal variances not assumed | 16.668 | -.017 | 1.598 | .001** | 13.443 | 19.578 |
| Psychological Distress (Sum of D, A, S) | Equal variances assumed | 53.771 | -.049 | 4.662 | .001** | 44.186 | 62.437 |
| | Equal variances not assumed | 53.771 | -.049 | 4.662 | .001** | 44.186 | 62.437 |

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

## Appendix 11

### Regression analysis using PROCESS tool (Hayes, 2013)

Run MATRIX procedure:
********** PROCESS Procedure for SPSS Release 2.12.1 **********
Written by Andrew F. Hayes, Ph.D. www.afhayes.com
Documentation available in Hayes (2013). www.guilford.com/p/hayes3
**************************************************************************
Model = 4 Y = FMTotal Sample size
X = AttachAnx 248
M = DASSTOTA
**************************************************************************
Outcome: Psych Distress Total
Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| ,4678 | ,2189 | 1064,7887 | 68,9328 | 1,0000 | 246,0000 | ,0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | -2,7276 | 5,7416 | -,4751 | ,6352 | -14,0366 | 8,5813 |
| Attach. Anxiety | ,7248 | ,0873 | 8,3026 | ,0000 | ,5528 | ,8967 |

**************************************************************************
Outcome: Fibromyalgia symptoms
Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| ,8170 | ,6674 | 308,6734 | 245,8364 | 2,0000 | 245,0000 | ,0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 11,3375 | 3,0928 | 3,6658 | ,0003 | 5,2456 | 17,4293 |
| Psych Distress Total | ,7061 | ,0343 | 20,5688 | ,0000 | ,6385 | ,7737 |
| Attach. Anxiety | -,1225 | ,0532 | -2,3031 | ,0221 | -,2272 | -,0177 |

********** TOTAL EFFECT MODEL **********
Outcome: Fibromyalgia symptoms
Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| ,3051 | ,0931 | 838,2821 | 25,2587 | 1,0000 | 246,0000 | ,0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 9,4115 | 5,0944 | 1,8474 | ,0659 | -,6227 | 19,4458 |
| Attach. Anxiety | ,3893 | ,0775 | 5,0258 | ,0000 | ,2367 | ,5418 |

********** TOTAL, DIRECT, AND INDIRECT EFFECTS **********
Total effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| ,3893 | ,0775 | 5,0258 | ,0000 | ,2367 | ,5418 |

Direct effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| -,1225 | ,0532 | -2,3031 | ,0221 | -,2272 | -,0177 |

Indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psychological distress | ,5118 | ,0561 | ,4022 | ,6331 |

Partially standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psychological distress | ,0169 | ,0017 | ,0138 | ,0204 |

Preacher and Kelley (2011) Kappa-squared

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psychological distress | ,4636 | ,0375 | ,3952 | ,5428 |

********** ANALYSIS NOTES AND WARNINGS **********
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output: 95,00
NOTE: Some cases were deleted due to missing data. The number of such cases was: 29
------ END MATRIX -----

**Run MATRIX procedure:**

*****

Indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych. Distress | .5930 | .0777 | .4381 | .7471 |

Partially standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych. Distress | .0195 | .0023 | .0149 | .0238 |

Completely standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych. Distress | .3766 | .0457 | .2832 | .4619 |

Ratio of indirect to total effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych. Distress | .9967 | .1125 | .8036 | 1.2342 |

Ratio of indirect to direct effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych. distress | 304.1233 | 219.1925 | 815.7377 | 3443.4497 |

R-squared mediation effect size (R-sq_med)

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych. distress | .1428 | .0412 | .0702 | .2333 |

Preacher and Kelley (2011) Kappa-squared

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych. distress | .4257 | .0427 | .3302 | .5016 |

Normal theory tests for indirect effect (sobel test)

| Effect | se | Z | p |
|---|---|---|---|
| .5930 | .0786 | 7.5487 | .0000 |

********** ANALYSIS NOTES AND WARNINGS **********
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output: 95.00
NOTE: Some cases were deleted due to missing data. The number of such cases was:29
------ END MATRIX -----

**Run MATRIX procedure:**
**********  **PROCESS Procedure for SPSS Release 2.12.1**  **********
**********

**Model = 4** **Y = Fibromyalgia symptoms** **Sample size**
**X = Attach. Anxiety** **253**
**M = Depression**

**********

Outcome: Depression

Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .4565 | .2084 | 152.2646 | 66.0790 | 1.0000 | 251.0000 | .0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | -2.8144 | 2.1433 | -1.3131 | .1903 | -7.0355 | 1.4067 |
| Attach. Anxiety | .2659 | .0327 | 8.1289 | .0000 | .2015 | .3303 |

**********

Outcome: Fibromyalgia symptoms

Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .7950 | .6320 | 341.4514 | 214.7013 | 2.0000 | 250.0000 | .0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 15.0568 | 3.2206 | 4.6752 | .0000 | 8.7139 | 21.3997 |
| Depression | 1.8115 | .0945 | 19.1649 | .0000 | 1.6253 | 1.9976 |
| Attach. Anxiety | -.0956 | .0551 | -1.7372 | .0836 | -.2041 | .0128 |

********** TOTAL EFFECT MODEL **********

Outcome: Fibromyalgia symptoms

Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .3023 | .0914 | 839.7462 | 25.2536 | 1.0000 | 251.0000 | .0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 9.9586 | 5.0333 | 1.9785 | .0490 | .0456 | 19.8715 |
| Attach. Anxiety | .3860 | .0768 | 5.0253 | .0000 | .2347 | .5373 |

********** TOTAL, DIRECT, AND INDIRECT EFFECTS **********

Total effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| .3860 | .0768 | 5.0253 | .0000 | .2347 | .5373 |

Direct effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| -.0956 | .0551 | -1.7372 | .0836 | -.2041 | .0128 |

Indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .4817 | .0554 | .3768 | .5869 |

Partially standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .0159 | .0017 | .0126 | .0190 |

Completely standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .3773 | .0434 | .2925 | .4607 |

Ratio of indirect to total effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | 1.2478 | .2020 | .9729 | 1.7390 |

Ratio of indirect to direct effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | -5.0362 | 242.8430 | -55.5729 | -2.0509 |

R-squared mediation effect size (R-sq_med)

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .0870 | .0377 | .0243 | .1702 |

Preacher and Kelley (2011) Kappa-squared

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .4288 | .0394 | .3471 | .5012 |

Normal theory tests for indirect effect

| Effect | se | Z | p |
|---|---|---|---|
| .4817 | .0644 | 7.4749 | .0000 |

********** ANALYSIS NOTES AND WARNINGS **********
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output: 95.00
NOTE: Some cases were deleted due to missing data. The number of such cases was: 24
----- END MATRIX -----

**Run MATRIX procedure:**

*****

********** TOTAL, DIRECT, AND INDIRECT EFFECTS **********

Total effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| .6155 | .0906 | 6.7960 | .0000 | .4371 | .7938 |

Direct effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| -.0165 | .0690 | -.2386 | .8116 | -.1523 | .1194 |

Indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .6319 | .0698 | .4937 | .7739 |

Partially standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .0206 | .0020 | .0166 | .0245 |

Completely standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .4034 | .0433 | .3211 | .4918 |

Ratio of indirect to total effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | 1.0267 | .1074 | .8420 | 1.2680 |

Ratio of indirect to direct effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | -38.3920 | 534.7996 | -6692.7213 | -12.2642 |

R-squared mediation effect size (R-sq_med)

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .1543 | .0404 | .0804 | .2411 |

Preacher and Kelley (2011) Kappa-squared

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Depression | .4364 | .0383 | .3621 | .5111 |

Normal theory tests for indirect effect

| Effect | se | Z | p |
|---|---|---|---|
| .6319 | .0767 | 8.2420 | .0000 |

********** ANALYSIS NOTES AND WARNINGS **********

Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000

WARNING: Bootstrap CI endpoints below not trustworthy. Decrease confidence or increase bootstraps-6692.7213

Level of confidence for all confidence intervals in output: 95.00

NOTE: Some cases were deleted due to missing data. The number of such cases was: 22

------ END MATRIX -----

**Run MATRIX procedure:**

******************* PROCESS Procedure for SPSS Release 2.12.1 ****************

**Model = 4 Y = Fibromyalgia symptoms Sample size**
**X = Attach. Anxiety 252**
**M = Anxiety**

******************

```
Anxiety     .3398       .0470       .2445       .4240

Ratio of indirect to total effect of X on Y
            Effect      Boot SE     BootLLCI    BootULCI
Anxiety     1.1437      .2155       .8524       1.6496

Ratio of indirect to direct effect of X on Y
            Effect      Boot SE     BootLLCI    BootULCI
Anxiety     -7.9577     126.2378    -2014.1086  3.9776

R-squared mediation effect size (R-sq_med)
            Effect      Boot SE     BootLLCI    BootULCI
Anxiety     .0868       .0392       .0191       .1744

Preacher and Kelley (2011) Kappa-squared
            Effect      Boot SE     BootLLCI    BootULCI
Anxiety     .3930       .0473       .2944       .4815

Normal theory tests for indirect effect
      Effect        se          Z           p
      .4332       .0634     6.8327      .0000
********************* ANALYSIS NOTES AND WARNINGS *************************
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output:    95.00
NOTE: Some cases were deleted due to missing data.  The number of such cases was: 25
------ END MATRIX -----
```

**Run MATRIX procedure:**

******************* PROCESS Procedure for SPSS Release 2.12.1 ****************

**Model = 4 Y = Fibromyalgia symptoms Sample size**
**X = Attach.Avoidance 252**
**M = Anxiety**

***************************************************************************

```
Outcome: Anxiety
Model Summary
      R       R-sq        MSE         F           df1         df2          p
   .4205     .1768    119.4355    53.6860      1.0000    250.0000     .0000
Model
                    coeff         se          t          p       LLCI       ULCI
constant          -4.3875     2.2869    -1.9186     .0562    -8.8915     .1165
Attach.Avoidance   .2619      .0357     7.3271     .0000     .1915      .3323
**************************************************************************
Outcome: Fibromyalgia symptoms
Model Summary
      R       R-sq        MSE         F           df1         df2          p
   .7907     .6252    346.5506    207.7108      2.0000    249.0000     .0000
Model
                    coeff         se          t          p       LLCI       ULCI
constant           6.3234     3.9240     1.6115     .1083    -1.4051    14.0520
Anxiety            1.9345      .1077    17.9568     .0000     1.7223     2.1467
Attach.Avoidance    .0804      .0671     1.1987     .2318     -.0517     .2126
```

********** TOTAL EFFECT MODEL **********
Outcome: Fibromyalgia symptoms
Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .3741 | .1399 | 792.1397 | 40.6757 | 1.0000 | 250.0000 | .0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | -2.1643 | 5.8895 | -.3675 | .7136 | -13.7636 | 9.4350 |
| Attach.Avoidance | .5870 | .0920 | 6.3777 | .0000 | .4058 | .7683 |

********** TOTAL, DIRECT, AND INDIRECT EFFECTS **********
Total effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| .5870 | .0920 | 6.3777 | .0000 | .4058 | .7683 |

Direct effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| .0804 | .0671 | 1.1987 | .2318 | -.0517 | .2126 |

Indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | .5066 | .0734 | .3688 | .6584 |

Partially standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | .0167 | .0022 | .0125 | .0209 |

Completely standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | .3228 | .0434 | .2393 | .4031 |

Ratio of indirect to total effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | .8630 | .1026 | .6996 | 1.1079 |

Ratio of indirect to direct effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | 6.2986 | 240.6354 | 1.6119 | 201.2638 |

R-squared mediation effect size (R-sq_med)

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | .1378 | .0390 | .0641 | .2147 |

Preacher and Kelley (2011) Kappa-squared

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | .3653 | .0433 | .2791 | .4478 |

Normal theory tests for indirect effect

| Effect | se | Z | p |
|---|---|---|---|
| .5066 | .0748 | 6.7750 | .0000 |

********** ANALYSIS NOTES AND WARNINGS **********
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output: 95.00
NOTE: Some cases were deleted due to missing data. The number of such cases was: 25
------ END MATRIX -----

**Run MATRIX procedure:**

******************* PROCESS Procedure for SPSS Release 2.12.1 ****************

**Model = 4 Y = Fibromyalgia symptoms Sample size**
**X = Attach.Anxiety 251**
**M = Stress**

******************

```
            Effect    Boot SE    BootLLCI   BootULCI
Stress      .3315     .0432       .2442       .4084

Ratio of indirect to total effect of X on Y
            Effect     Boot SE    BootLLCI     BootULCI
Stress      1.0679      .1878      .7944        1.4858
Ratio of indirect to direct effect of X on Y
            Effect     Boot SE     BootLLCI     BootULCI
Stress    -15.7170   314.3826    -9293.9089     -4.4800

R-squared mediation effect size (R-sq_med)
            Effect    Boot SE   BootLLCI    BootULCI
Stress      .0960     .0369       .0360       .1820

Preacher and Kelley (2011) Kappa-squared
          Effect    Boot SE   BootLLCI   BootULCI
Stress      .3525     .0408      .2694      .4322

Normal theory tests for indirect effect
    Effect         se          Z          p
    .4223      .0599     7.0464     .0000
********************* ANALYSIS NOTES AND WARNINGS *************************
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
WARNING: Bootstrap CI endpoints below not trustworthy.  Decrease confidence or increase
bootstraps -9293.9089
Level of confidence for all confidence intervals in output: 95.00
NOTE: Some cases were deleted due to missing data.  The number of such cases was: 26
------ END MATRIX -----
```

**Run MATRIX procedure:**

****************** PROCESS Procedure for SPSS Release 2.12.1 ****************

**Model = 4** **Y = Fibromyalgia symptoms** **Sample size**

**X = Attach.Avoidance** **251**

**M = Stress**

*****************

```
************************** TOTAL EFFECT MODEL ****************************
Outcome: Fibromyalgia symptoms
Model Summary
  R       R-sq        MSE         F         df1         df2           p
.3718     .1383    797.9867    39.9497    1.0000   249.0000      .0000
Model
                    coeff         se         t         p      LLCI      ULCI
constant          -1.8049     5.8772    -.3071    .7590  -13.3802    9.7705
Attach.Avoidance   .5785      .0915    6.3206    .0000     .3983     .7588

****************** TOTAL, DIRECT, AND INDIRECT EFFECTS ********************
Total effect of X on Y
   Effect        SE         t           p       LLCI      ULCI
    .5785     .0915    6.3206     .0000     .3983     .7588

Direct effect of X on Y
   Effect        SE         t           p       LLCI      ULCI
    .1814     .0728    2.4917     .0134     .0380     .3247

Indirect effect of X on Y
         Effect    Boot SE   BootLLCI   BootULCI
Stress     .3972     .0655     .2613         .5228

Partially standardized indirect effect of X on Y
          Effect    Boot SE   BootLLCI   BootULCI
Stress     .0131     .0020     .0089         .0168

Completely standardized indirect effect of X on Y
         Effect    Boot SE   BootLLCI   BootULCI
Stress     .2553     .0402     .1752         .3321

Ratio of indirect to total effect of X on Y
         Effect    Boot SE   BootLLCI   BootULCI
Stress     .6865     .1055     .5061         .9104

Ratio of indirect to direct effect of X on Y
          Effect    Boot SE   BootLLCI   BootULCI
Stress     2.1897   65.5801    1.0001       9.6787

R-squared mediation effect size (R-sq_med)
          Effect    Boot SE   BootLLCI   BootULCI
Stress     .1266     .0343     .0660         .2031

Preacher and Kelley (2011) Kappa-squared
         Effect    Boot SE   BootLLCI   BootULCI
Stress     .2799     .0413     .1972         .3599

Normal theory tests for indirect effect
    Effect         se          Z          p
    .3972     .0679     5.8467     .0000
********************* ANALYSIS NOTES AND WARNINGS *************************
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output:    95.00
NOTE: Some cases were deleted due to missing data.  The number of such cases was:  26
------ END MATRIX -----
```

**Run MATRIX procedure:**

******************* PROCESS Procedure for SPSS Release 2.12.1 ****************

**Model = 4 Y = Fibromyalgia symptoms Sample size**
**X = Mentalization 217**
**M = Psychological distress**

******************

Completely standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych.distress | -.1948 | .0526 | -.2943 | -.0924 |

Ratio of indirect to total effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych.distress | .7096 | .1742 | .4164 | 1.0649 |

Ratio of indirect to direct effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych.distress | 2.4438 | 36.9157 | -9.4898 | 31.7325 |

R-squared mediation effect size (R-sq_med)

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych.distress | .0694 | .0324 | .0197 | .1444 |

Preacher and Kelley (2011) Kappa-squared

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Psych.distress | .2476 | .0608 | .1235 | .3586 |

Normal theory tests for indirect effect

| Effect | se | Z | p |
|---|---|---|---|
| -.2124 | .0577 | -3.6838 | .0002 |

********** ANALYSIS NOTES AND WARNINGS **********
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output: 95.00
NOTE: Some cases were deleted due to missing data. The number of such cases was: 60
------ END MATRIX -----

**Run MATRIX procedure:**
**********  **PROCESS Procedure for SPSS Release 2.12.1 **********
**Model = 4  Y = FMTotal  Sample size**
**X = RFQ54Tot  222**
**M = DASSDepr**
**************************************************************************
Outcome: Depression
Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .2314 | .0535 | 188.7500 | 12.4415 | 1.0000 | 220.0000 | .0005 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 41.2709 | 7.8611 | 5.2500 | .0000 | 25.7782 | 56.7636 |
| Mentalization | -.1157 | .0328 | -3.5272 | .0005 | -.1804 | -.0511 |

**************************************************************************

Outcome: Fibromyalgia
Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .7791 | .6070 | 374.2656 | 169.0915 | 2.0000 | 219.0000 | .0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 34.7949 | 11.7425 | 2.9632 | .0034 | 11.6520 | 57.9377 |
| Depression | 1.6452 | .0949 | 17.3295 | .0000 | 1.4581 | 1.8323 |
| Mentalization | -.0939 | .0475 | -1.9779 | .0492 | -.1876 | -.0003 |

```
************************** TOTAL EFFECT MODEL ****************************
Outcome: Fibromyalgia symptoms
Model Summar
      R       R-sq        MSE          F          df1         df2          p
 .2607     .0680    883.4546    16.0444     1.0000    220.0000     .0001
Model
                    coeff         se          t          p       LLCI      ULCI
constant         102.6940    17.0072     6.0383     .0000    69.1761  136.2119
Mentalization      -.2844       .0710    -4.0055     .0001     -.4243    -.1445

****************** TOTAL, DIRECT, AND INDIRECT EFFECTS *********************
Total effect of X on Y
    Effect         SE          t          p       LLCI       ULCI
    -.2844     .0710    -4.0055     .0001     -.4243    -.1445

Direct effect of X on Y
    Effect         SE          t          p       LLCI       ULCI
    -.0939     .0475    -1.9779     .0492     -.1876    -.0003

Indirect effect of X on Y
              Effect    Boot SE   BootLLCI    BootULCI
Depression   -.1904      .0571     -.3059       -.0715

Partially standardized indirect effect of X on Y
              Effect    Boot SE   BootLLCI   BootULCI
Depression   -.0062      .0018     -.0097      -.0024

Completely standardized indirect effect of X on Y
              Effect    Boot SE   BootLLCI   BootULCI
Depression   -.1746      .0494     -.2644      -.0605

Ratio of indirect to total effect of X on Y
              Effect    Boot SE   BootLLCI   BootULCI
Depression    .6696       .1678      .3874       1.0855

Ratio of indirect to direct effect of X on Y
              Effect    Boot SE   BootLLCI   BootULCI
Depression   2.0271    35.1406      .4810      27.6144

R-squared mediation effect size (R-sq_med)
              Effect    Boot SE   BootLLCI   BootULCI
Depression    .0610      .0300      .0154       .1358

Preacher and Kelley (2011) Kappa-squared
              Effect    Boot SE   BootLLCI   BootULCI
Depression    .2165      .0563      .0834       .3159

Normal theory tests for indirect effect
    Effect         se          Z          p
    -.1904     .0552    -3.4509     .0006
******************** ANALYSIS NOTES AND WARNINGS *************************
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output:    95.00
NOTE: Some cases were deleted due to missing data.  The number of such cases was: 55
------ END MATRIX -----
```

**Run MATRIX procedure:**

******************* PROCESS Procedure for SPSS Release 2.12.1 ****************

**Model = 4 Y = Fibromyalgia symptoms Sample size**
**X = Mentalization 222**
**M = Anxiety**

******************

Ratio of indirect to total effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | .5899 | .1544 | .3000 | .8959 |

Ratio of indirect to direct effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | 1.4383 | 83.8219 | .3962 | 7.1724 |

R-squared mediation effect size (R-sq_med)

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | .0574 | .0307 | .0123 | .1277 |

Preacher and Kelley (2011) Kappa-squared

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Anxiety | .1959 | .0586 | .0807 | .3121 |

Normal theory tests for indirect effect

| Effect | se | Z | p |
|---|---|---|---|
| -.1684 | .0561 | -3.0017 | .0027 |

********** ANALYSIS NOTES AND WARNINGS **********
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output: 95.00
NOTE: Some cases were deleted due to missing data. The number of such cases was: 55
------ END MATRIX -----

**Run MATRIX procedure:**

**********  **PROCESS Procedure for SPSS Release 2.12.1**  **********

**Model = 4** **Y = Fibromyalgia symptoms** **Sample size**
**X = Mentalization** **220**
**M = Stress**

**********

Outcome: Stress
Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .2456 | .0603 | 158.8938 | 13.9952 | 1.0000 | 218.0000 | .0002 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 43.7110 | 7.2713 | 6.0114 | .0000 | 29.3800 | 58.0420 |
| Mentalization | -.1136 | .0304 | -3.7410 | .0002 | -.1734 | -.0537 |

**********

Outcome: Fibromyalgia symptoms
Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .7269 | .5283 | 448.9503 | 121.5377 | 2.0000 | 217.0000 | .0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 33.5680 | 13.1966 | 2.5437 | .0117 | 7.5580 | 59.5780 |
| Stress | 1.6465 | .1138 | 14.4627 | .0000 | 1.4221 | 1.8709 |
| Mentalization | -.1101 | .0526 | -2.0924 | .0376 | -.2139 | -.0064 |

********** TOTAL EFFECT MODEL **********
Outcome: Fibromyalgia symptoms
Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .2715 | .0737 | 877.6537 | 17.3445 | 1.0000 | 218.0000 | .0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 105.5388 | 17.0891 | 6.1758 | .0000 | 71.8577 | 139.2199 |
| Mentalization | -.2971 | .0713 | -4.1647 | .0000 | -.4377 | -.1565 |

********** TOTAL, DIRECT, AND INDIRECT EFFECTS **********
Total effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| -.2971 | .0713 | -4.1647 | .0000 | -.4377 | -.1565 |

Direct effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| -.1101 | .0526 | -2.0924 | .0376 | -.2139 | -.0064 |

Indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Stress | -.1870 | .0583 | -.3076 | -.0715 |

Partially standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Stress | -.0061 | .0019 | -.0099 | -.0023 |

Completely standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Stress | -.1708 | .0495 | -.2660 | -.0708 |

Ratio of indirect to total effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Stress | .6293 | .2064 | .3479 | 1.1183 |

Ratio of indirect to direct effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Stress | 1.6977 | 3604.2678 | .2660 | 24.3260 |

R-squared mediation effect size (R-sq_med)

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Stress | .0642 | .0303 | .0170 | .1322 |

Preacher and Kelley (2011) Kappa-squared

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| Stress | .1993 | .0546 | .0816 | .3031 |

Normal theory tests for indirect effect

| Effect | se | Z | p |
|---|---|---|---|
| -.1870 | .0517 | -3.6137 | .0003 |

********** ANALYSIS NOTES AND WARNINGS **********
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output: 95.00
NOTE: Some cases were deleted due to missing data. The number of such cases was: 57
------ END MATRIX -----

**Run MATRIX procedure:**

******************* PROCESS Procedure for SPSS Release 2.12.1 ****************

**Written by Andrew F. Hayes, Ph.D. www.afhayes.com**

**Documentation available in Hayes (2013). www.guilford.com/p/hayes3**

**********************************************************************

**Model = 4** **Y = Fibromyalgia symptoms** **Sample size**

**X = Attach.Avoidance** **217**

**M = Mentalization**

**********************************************************************

Outcome: Mentalization

Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .1679 | .0282 | 701.7275 | 6.2387 | 1.0000 | 215.0000 | .0132 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 253.7431 | 6.0241 | 42.1211 | .0000 | 241.8692 | 265.6171 |
| Attachme | -.2306 | .0923 | -2.4977 | .0132 | -.4127 | -.0486 |

******************************************************************

Outcome: FMTotal

Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .3922 | .1538 | 777.6330 | 19.4539 | 2.0000 | 214.0000 | .0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | 53.1277 | 19.2893 | 2.7543 | .0064 | 15.1063 | 91.1490 |
| mentalization | -.2060 | .0718 | -2.8690 | .0045 | -.3475 | -.0645 |
| Attach.Avoidance | .4909 | .0986 | 4.9783 | .0000 | .2965 | .6853 |

************************** TOTAL EFFECT MODEL ****************************

Outcome: Fibromyalgia symptoms

Model Summary

| R | R-sq | MSE | F | df1 | df2 | p |
|---|---|---|---|---|---|---|
| .3483 | .1213 | 803.7864 | 29.6787 | 1.0000 | 215.0000 | .0000 |

Model

| | coeff | se | t | p | LLCI | ULCI |
|---|---|---|---|---|---|---|
| constant | .8638 | 6.4473 | .1340 | .8935 | -11.8443 | 13.5719 |
| Attach.Avoidance | .5384 | .0988 | 5.4478 | .0000 | .3436 | .7332 |

***************** TOTAL, DIRECT, AND INDIRECT EFFECTS ********************

Total effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| .5384 | .0988 | 5.4478 | .0000 | .3436 | .7332 |

Direct effect of X on Y

| Effect | SE | t | p | LLCI | ULCI |
|---|---|---|---|---|---|
| .4909 | .0986 | 4.9783 | .0000 | .2965 | .6853 |

Indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| RFQ54Tot | .0475 | .0261 | .0105 | .1213 |

Partially standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| RFQ54Tot | .0016 | .0009 | .0004 | .0039 |

Completely standardized indirect effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| RFQ54Tot | .0307 | .0166 | .0074 | .0777 |

Ratio of indirect to total effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| RFQ54Tot | .0882 | .0501 | .0214 | .2331 |

Ratio of indirect to direct effect of X on Y

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| RFQ54Tot | .0968 | .0640 | .0218 | .3039 |

R-squared mediation effect size (R-sq_med)

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| RFQ54Tot | .0233 | .0134 | .0044 | .0577 |

Preacher and Kelley (2011) Kappa-squared

| | Effect | Boot SE | BootLLCI | BootULCI |
|---|---|---|---|---|
| RFQ54Tot | .0325 | .0171 | .0079 | .0802 |

Normal theory tests for indirect effect

| Effect | se | Z | p |
|---|---|---|---|
| .0475 | .0261 | 1.8219 | .0685 |

********** ANALYSIS NOTES AND WARNINGS **********
Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000
Level of confidence for all confidence intervals in output: 95.00
NOTE: Some cases were deleted due to missing data. The number of such cases was: 60
------ END MATRIX -----

## Appendix 12

### Journal Submission Guidelines: Journal of Psychosomatic Research

Please write your text in good English (American or British usage is accepted, but not a mixture of these). Authors who feel their English language manuscript may require editing to eliminate possible grammatical or spelling errors and to conform to correct scientific English may wish to use the English Language Editing service available from Elsevier's WebShop (http://webshop.elsevier.com/languageediting/) or visit our customer support site (http://support.elsevier.com) for more information.

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The Journal of Psychosomatic Research utilizes a web-based submission and peer review system. Authors should submit their manuscripts, with figures and tables, electronically at the journal Web site: http://ees.elsevier.com/jpsychores . Complete instructions are available on the Web site.

The journal reviews all material that it receives. Approximately 50% of manuscripts are rejected after pre-review by an editor, typically after consultation with another member of the editorial staff or an external peer reviewer. This is done so as to allow authors whose manuscripts would almost certainly be rejected after peer review to submit the work elsewhere with as little delay as possible. Common reasons for rejection at this stage are insufficient originality, low priority of interest to the journal and clear quality deficits. We attempt to reach an initial decision on all articles that go through full peer review within 90 days of submission. Approximately 25% of submitted manuscripts are ultimately accepted for publication.

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Manuscripts should conform to the uniform requirements known as the 'Vancouver style' (International Committee of Medical Journal Editors. Uniform requirements for manuscripts submitted to biomedical journals. N Engl J Med 1997; 336:309-315). The Editors and Referees attach considerable importance to a succinct and lucid prose style and well organized tables. Authors whose native language is not English are advised to seek help before submission. Statistical procedures should be clearly explained.Manuscripts should conform to the uniform requirements known as the 'Vancouver style' (International Committee of Medical Journal Editors. Uniform requirements for manuscripts submitted to biomedical journals. N Engl J Med 1997; 336:309-315). The Editors and Referees attach considerable importance to a succinct and lucid prose style and well organized tables. Authors whose native language is not English are advised to seek help before submission. Statistical procedures should be clearly explained.

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Submission to this journal proceeds totally online and you will be guided stepwise through the creation and uploading of your files. The system automatically converts your files to a single PDF file, which is used in the peer-review process.
As part of the Your Paper Your Way service, you may choose to submit your manuscript as a single file to be used in the refereeing process. This can be a PDF file or a Word document, in

any format or lay-out that can be used by referees to evaluate your manuscript. It should contain high enough quality figures for refereeing. If you prefer to do so, you may still provide all or some of the source files at the initial submission. Please note that individual figure files larger than 10 MB must be uploaded separately.

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There are no strict requirements on reference formatting at submission. References can be in any style or format as long as the style is consistent. Where applicable, author(s) name(s), journal title/book title, chapter title/article title, year of publication, volume number/book chapter and the pagination must be present. Use of DOI is highly encouraged. The reference style used by the journal will be applied to the accepted article by Elsevier at the proof stage. Note that missing data will be highlighted at proof stage for the author to correct.

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If your article includes any Videos and/or other Supplementary material, this should be included in your initial submission for peer review purposes.
Divide the article into clearly defined sections.

**Figures and tables embedded in text**
Please ensure the figures and the tables included in the single file are placed next to the relevant text in the manuscript, rather than at the bottom or the top of the file.